



XP-SWMM VS ICM VS HEC-RAS:

WHICH MODEL TO CHOOSE?

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MEETING AGENDA

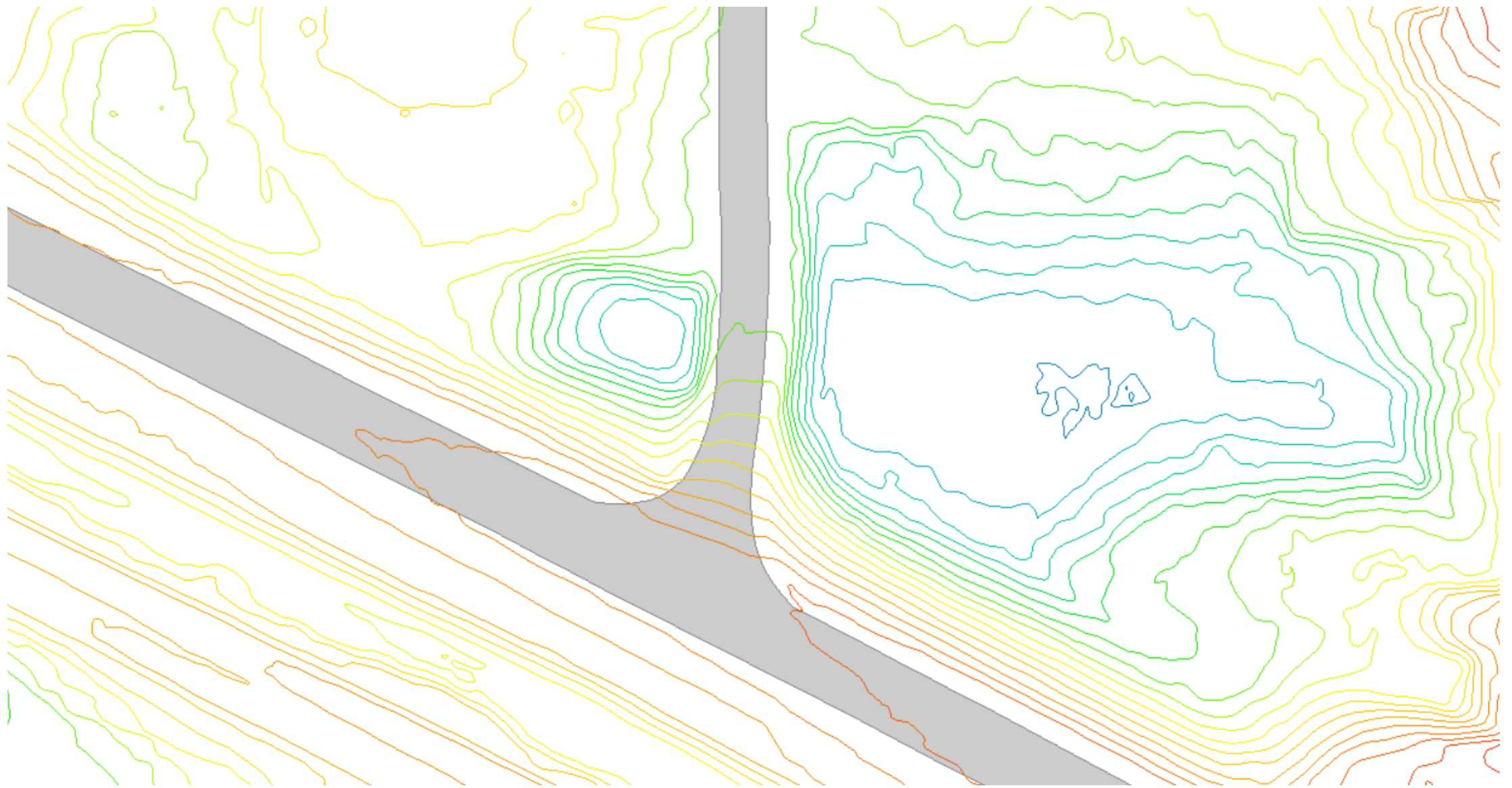




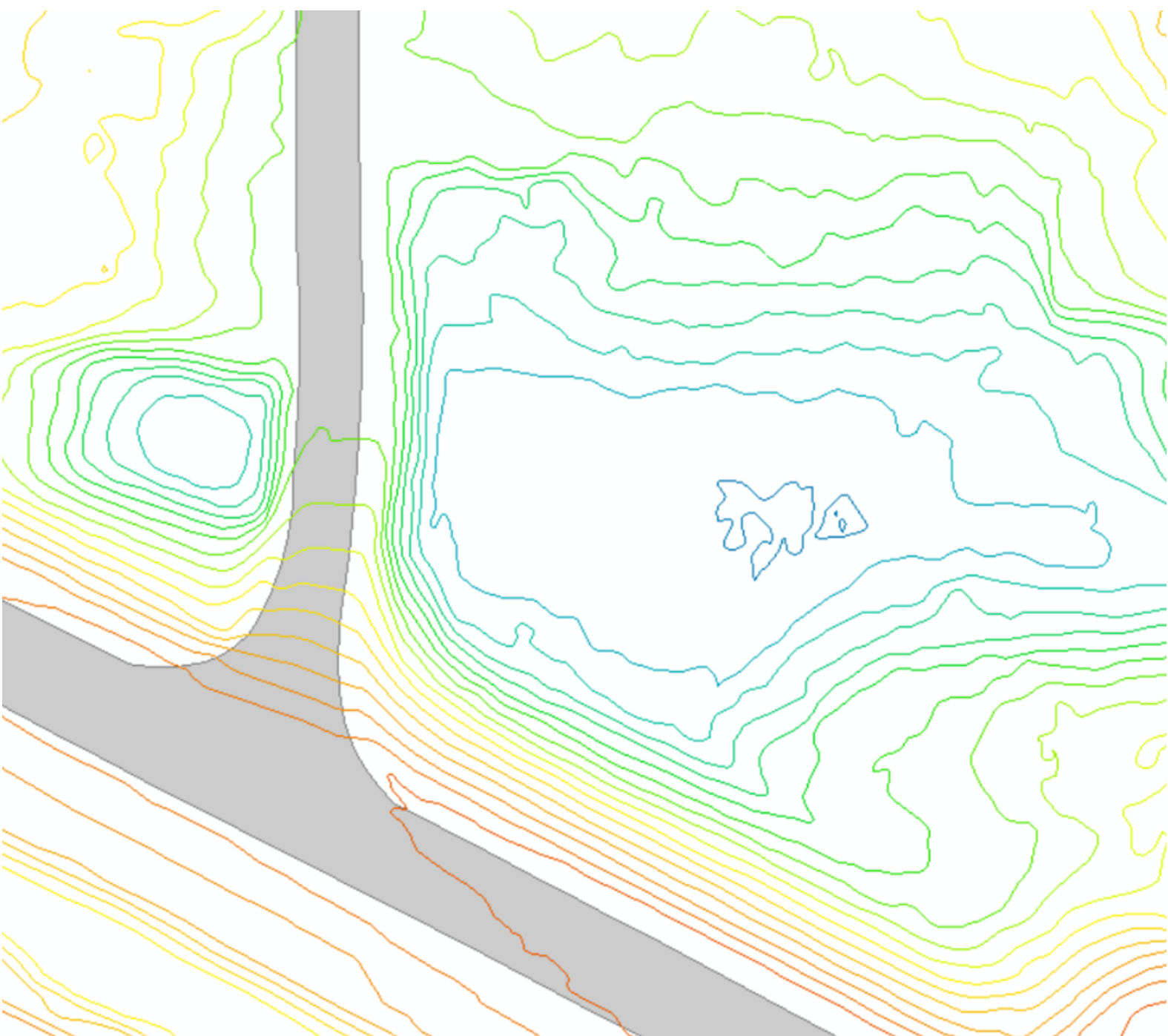
PROJECT DESCRIPTION



ISOLATED DEPRESSIONS

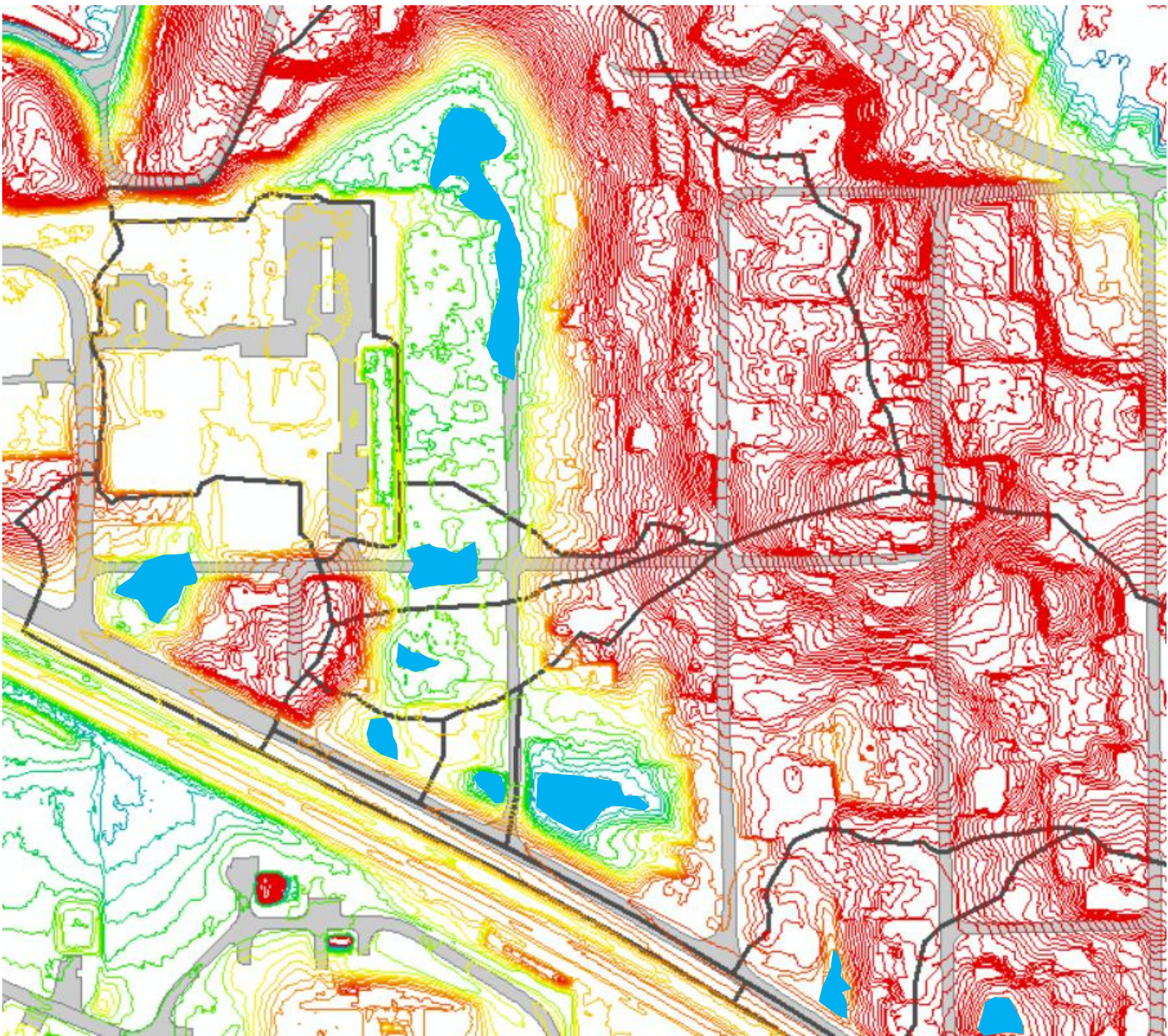


ISOLATED DEPRESSIONS



REGULATORY CRITERIA: ISOLATED DEPRESSIONS

- Must maintain volume
- If storage volume > 0.75 ac-ft when inundated, regulated as non-riverine Regulatory Floodplain
- Model using hydrograph method



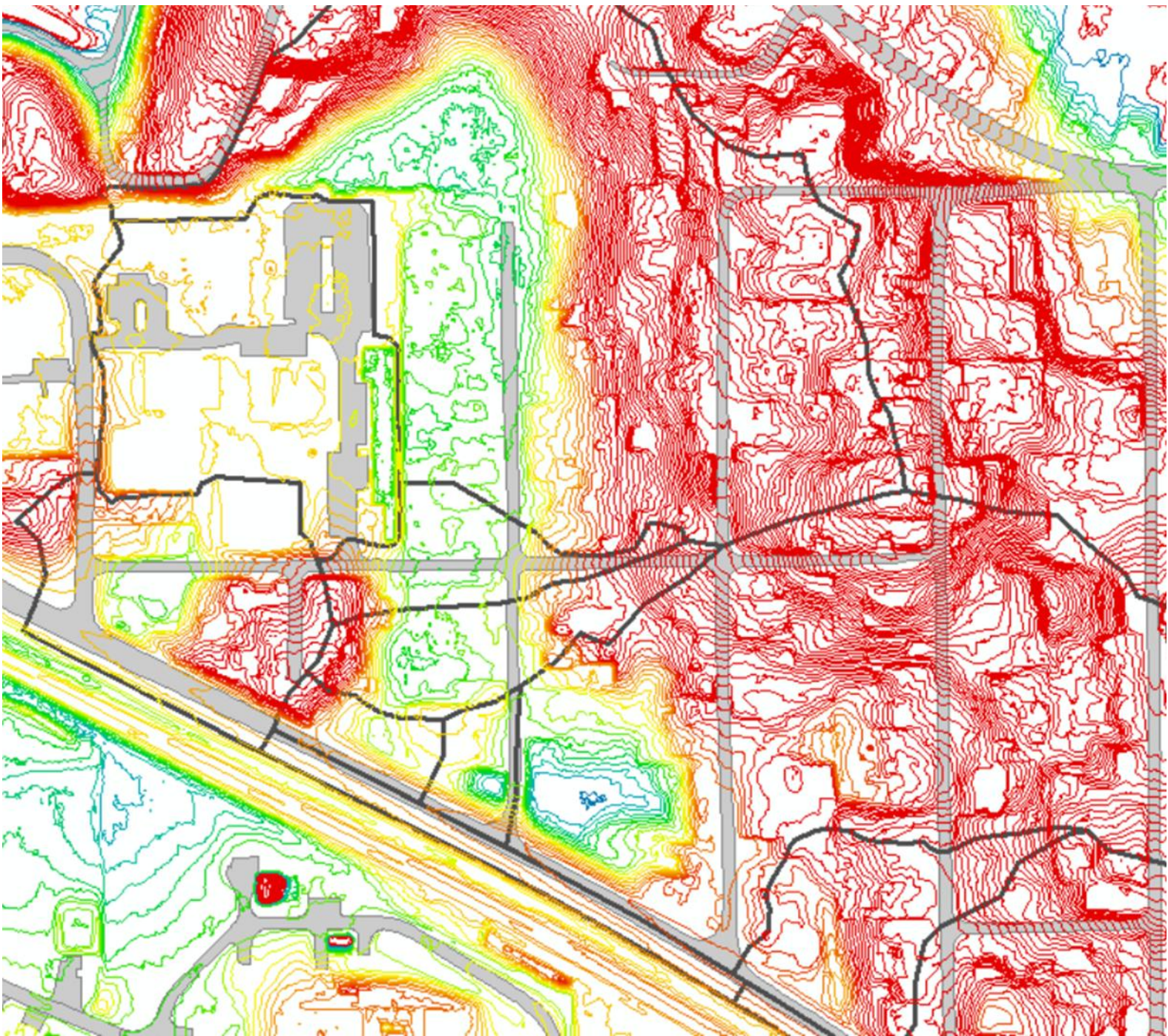
HYDROLOGIC INPUT DATA

- Tributary area delineation
- Depressions may be influenced by other adjacent depressions.
- Do they overflow into each other?



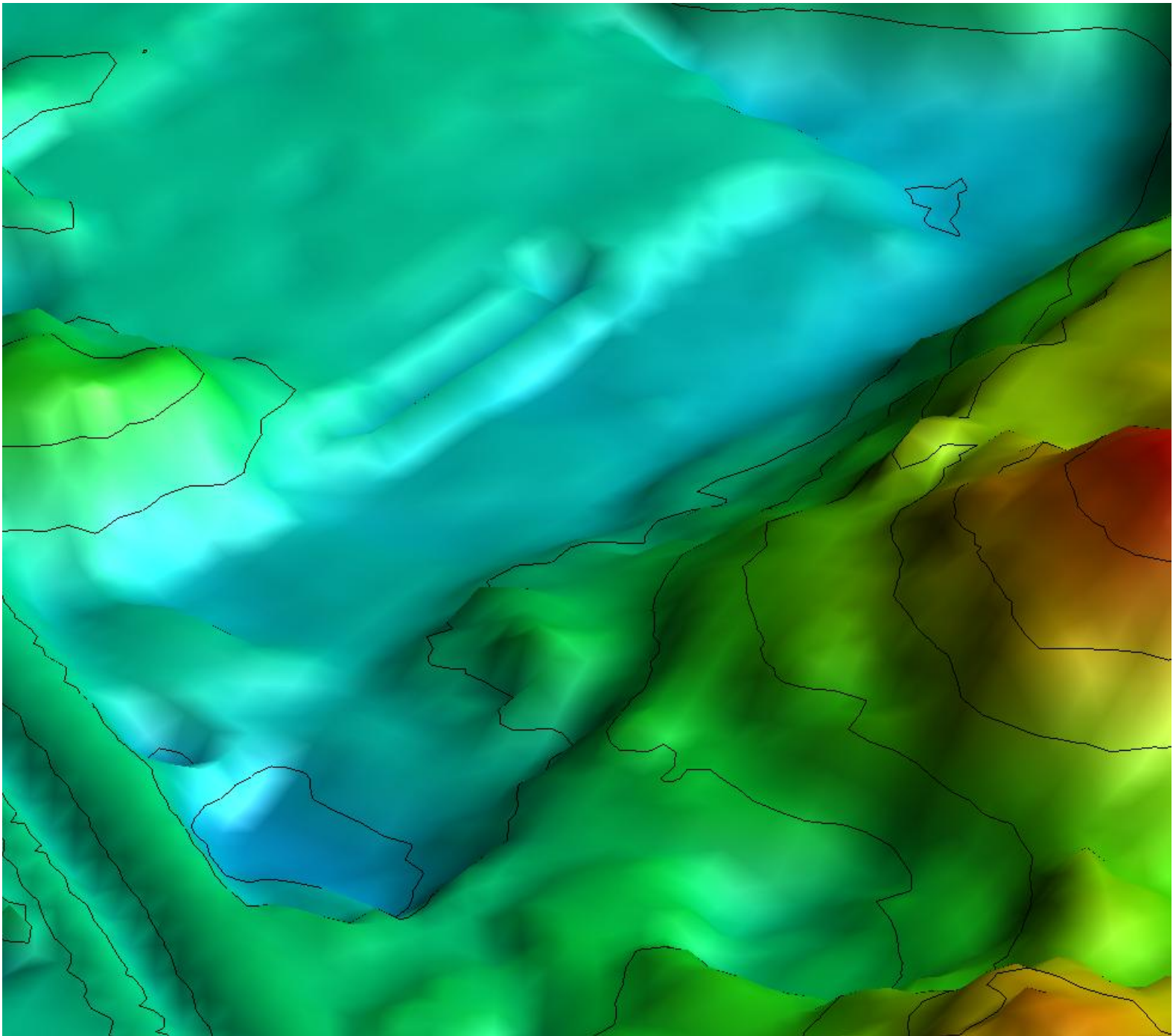
CHOOSE MODELING SOFTWARE

- Analogy: ice cube tray
- Dynamic model needed



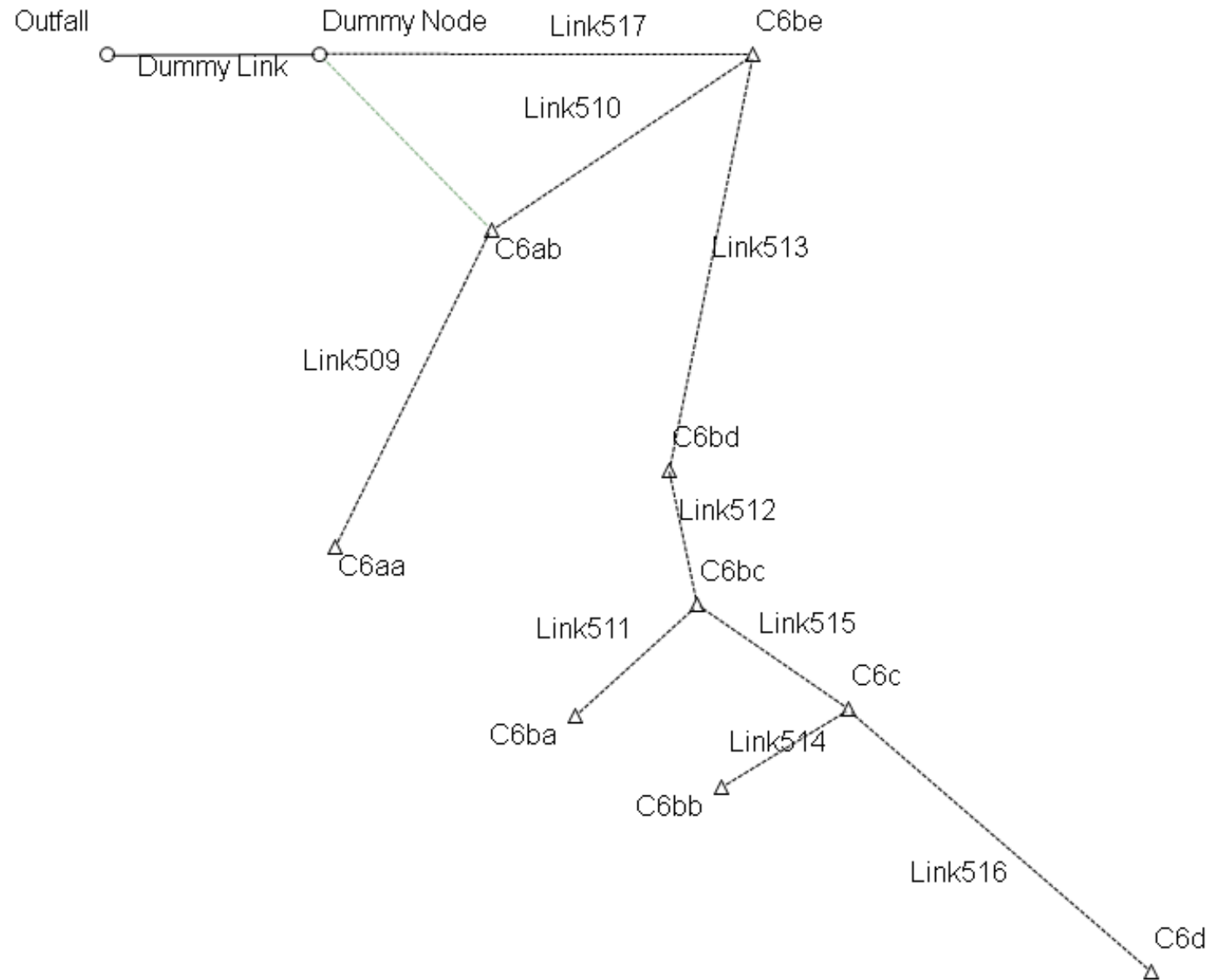
CHOOSE MODELING SOFTWARE

- Analogy: ice cube tray
- Dynamic model needed:
 - XP-SWMM?
 - Tried and true
 - Sunsetting
 - ICM?
 - XPSWMM replacement
 - Build natively or do XPS import
 - Let's try both!
 - And then add HEC-RAS 6.6 for good measure
 - (all with 1D models)



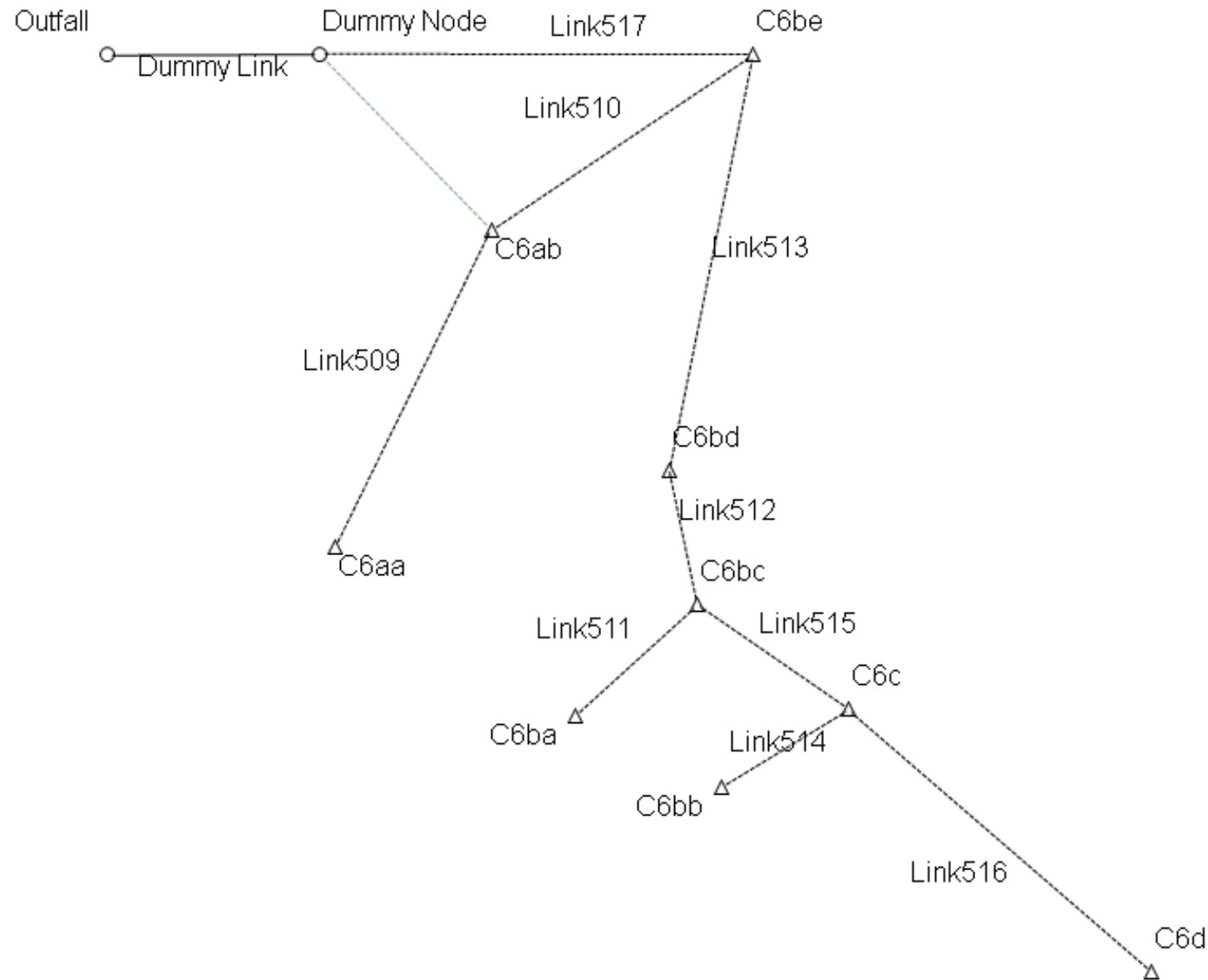
MODEL SETUP

- Natural terrain overflows



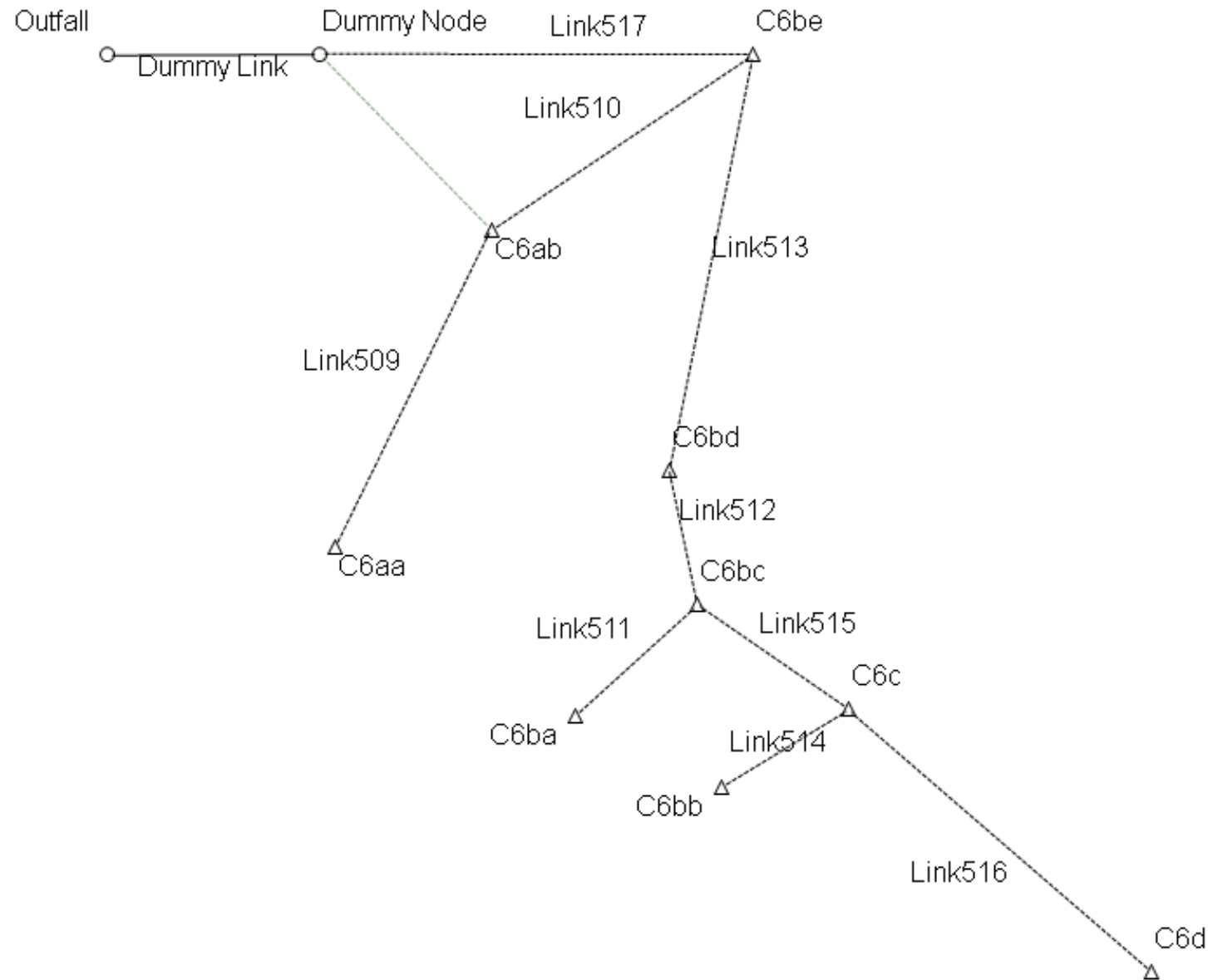
XPSWMM SETUP

- Natural terrain overflows



XPSWMM SETUP

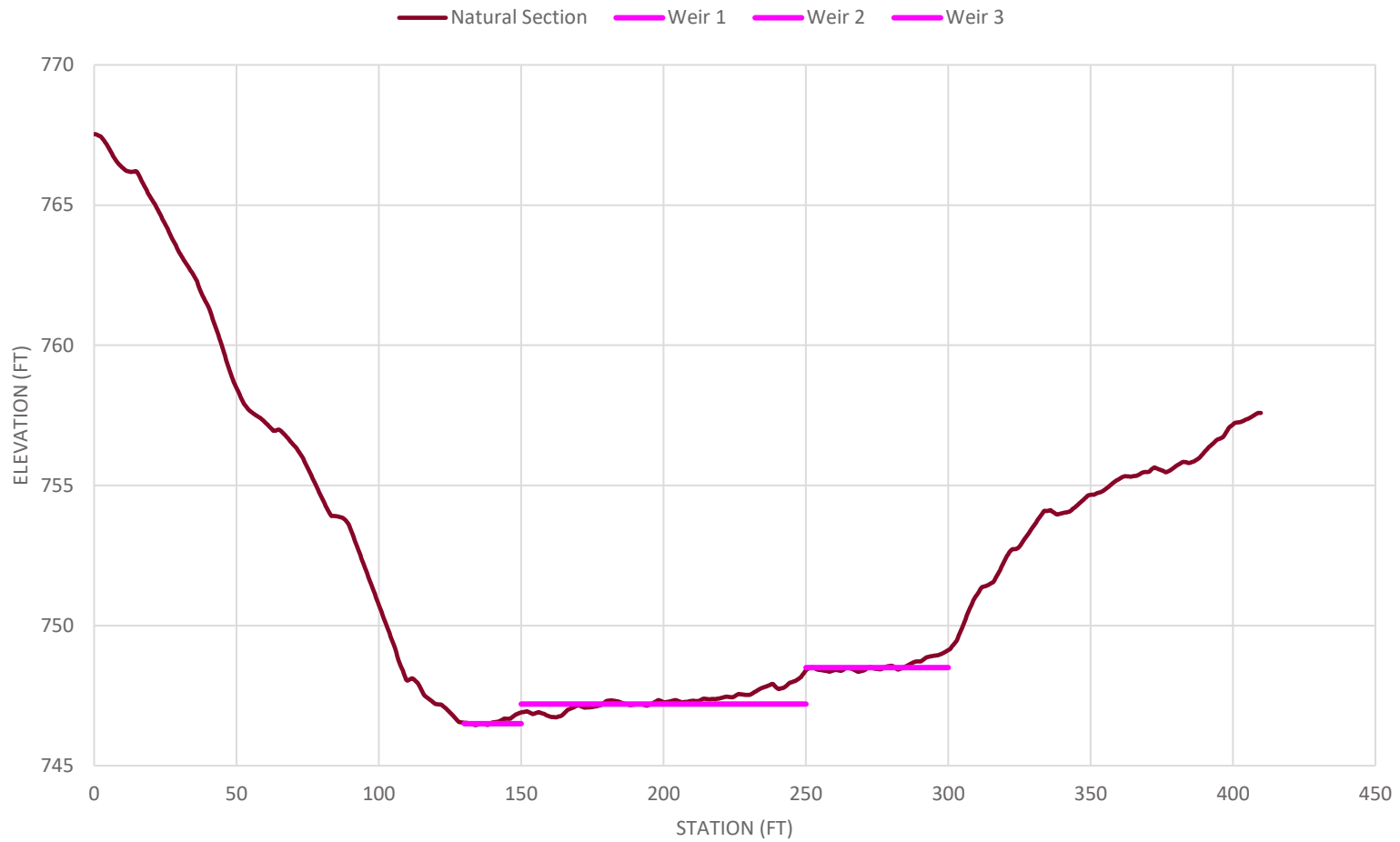
- Natural terrain overflows
- Series of weirs or channels?
 - Series of simple weirs



XPSWMM SETUP

- Natural terrain overflows
- Series of weirs or channels?
 - Series of simple weirs
 - Short channels (trapezoidal, irregular)

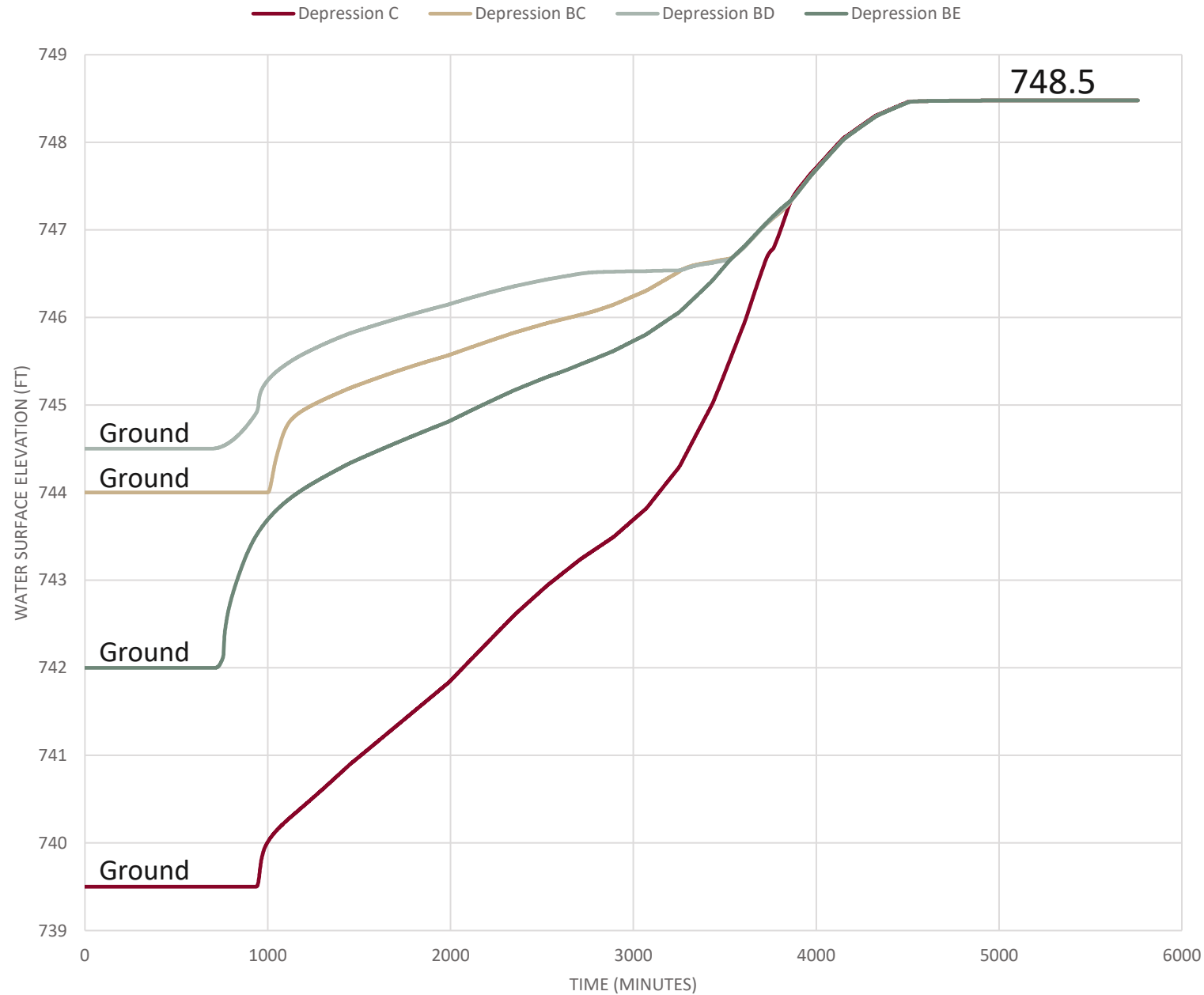
OVERFLOW SERIES OF SIMPLE WEIRS



XPSWMM SETUP

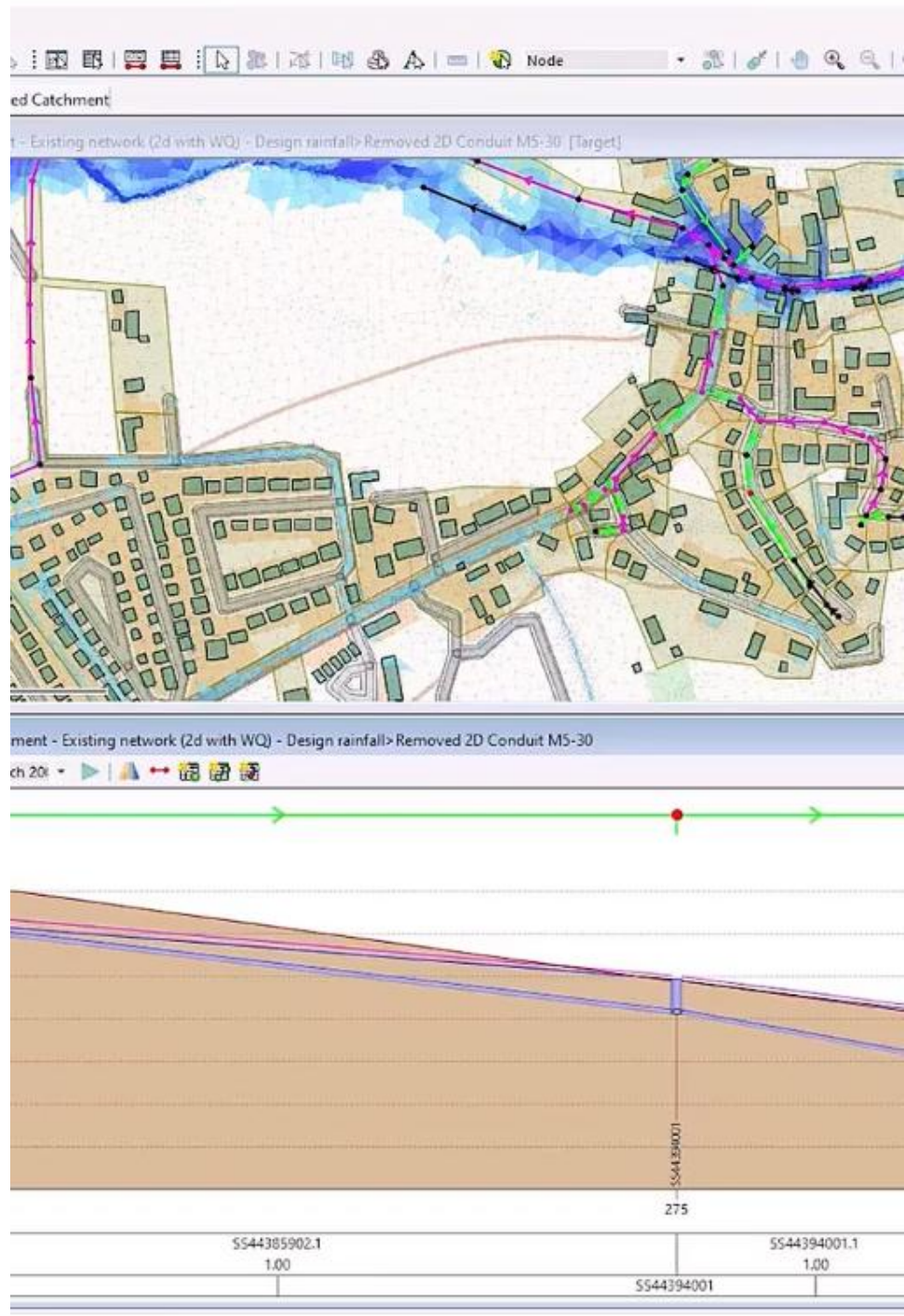
- Natural terrain overflows
- Series of weirs or channels?
 - Series of simple weirs
 - Short channels (trapezoidal, irregular)

XPSWMM RESULTS: WATER LEVELS



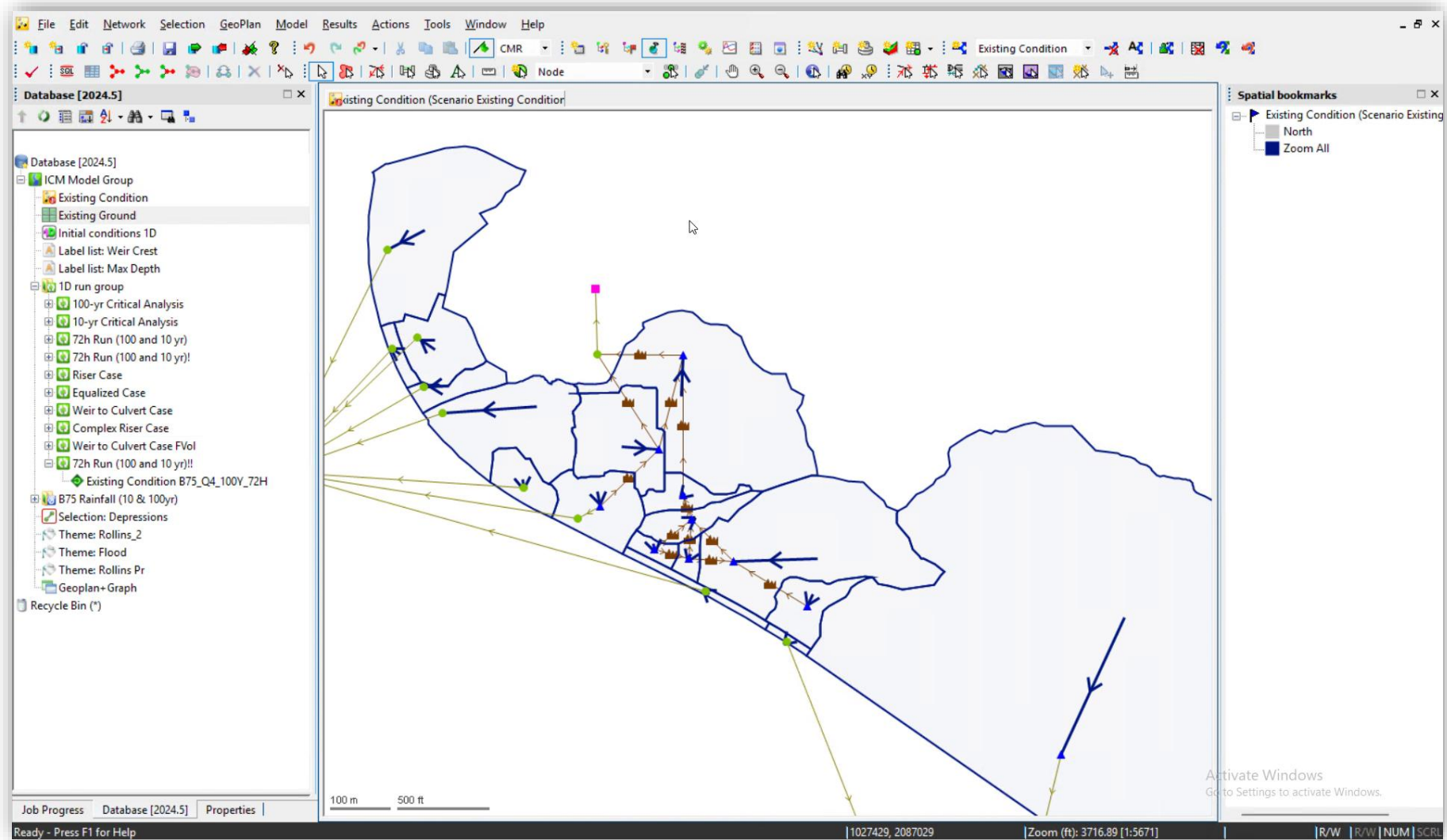
XPSWMM RESULTS

- Using a series of simple weirs approach
- Each depression equalizes as expected

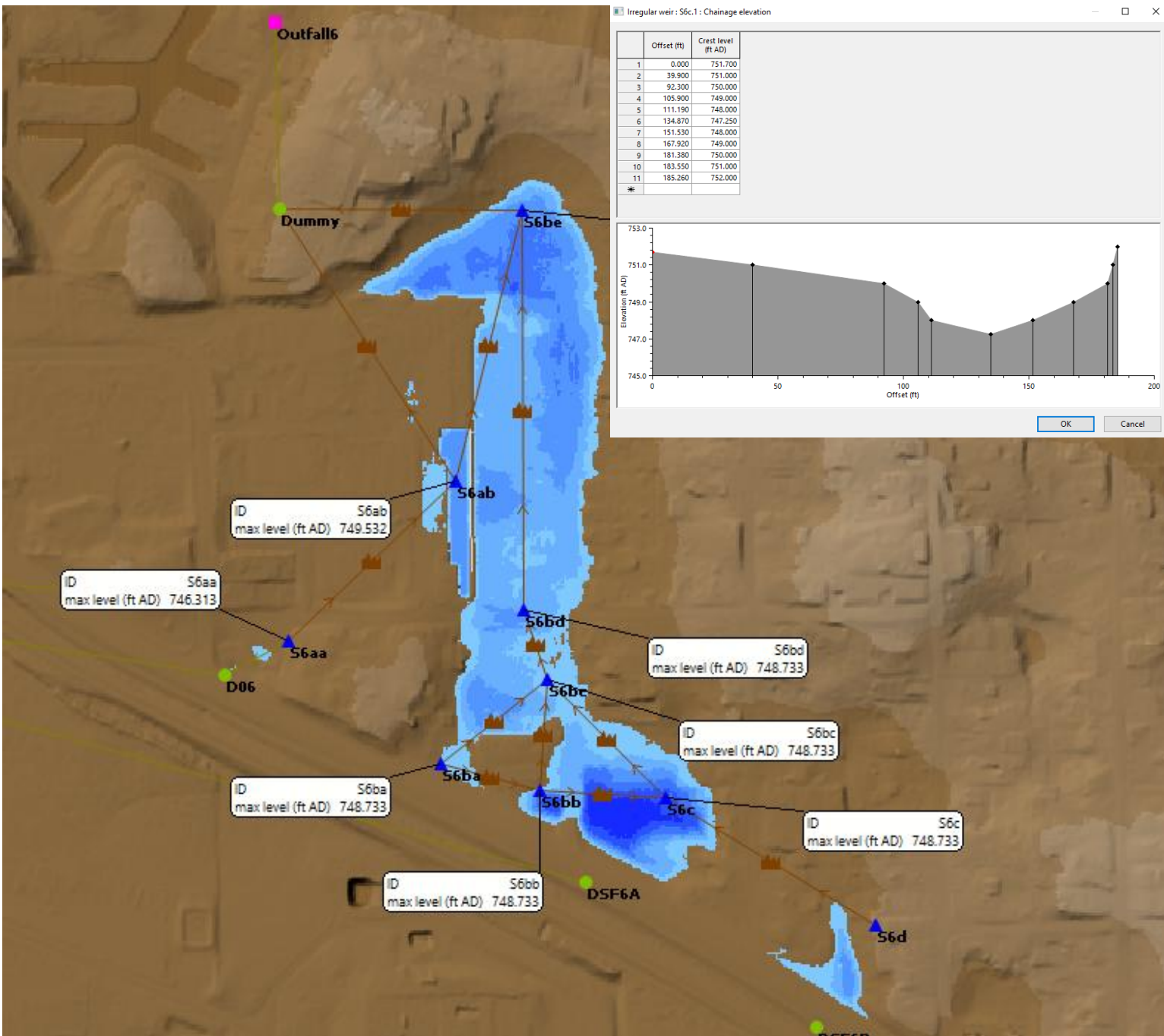


ICM SETUP

- Easy to build model from scratch
- Active and growing support
- Powerful new features

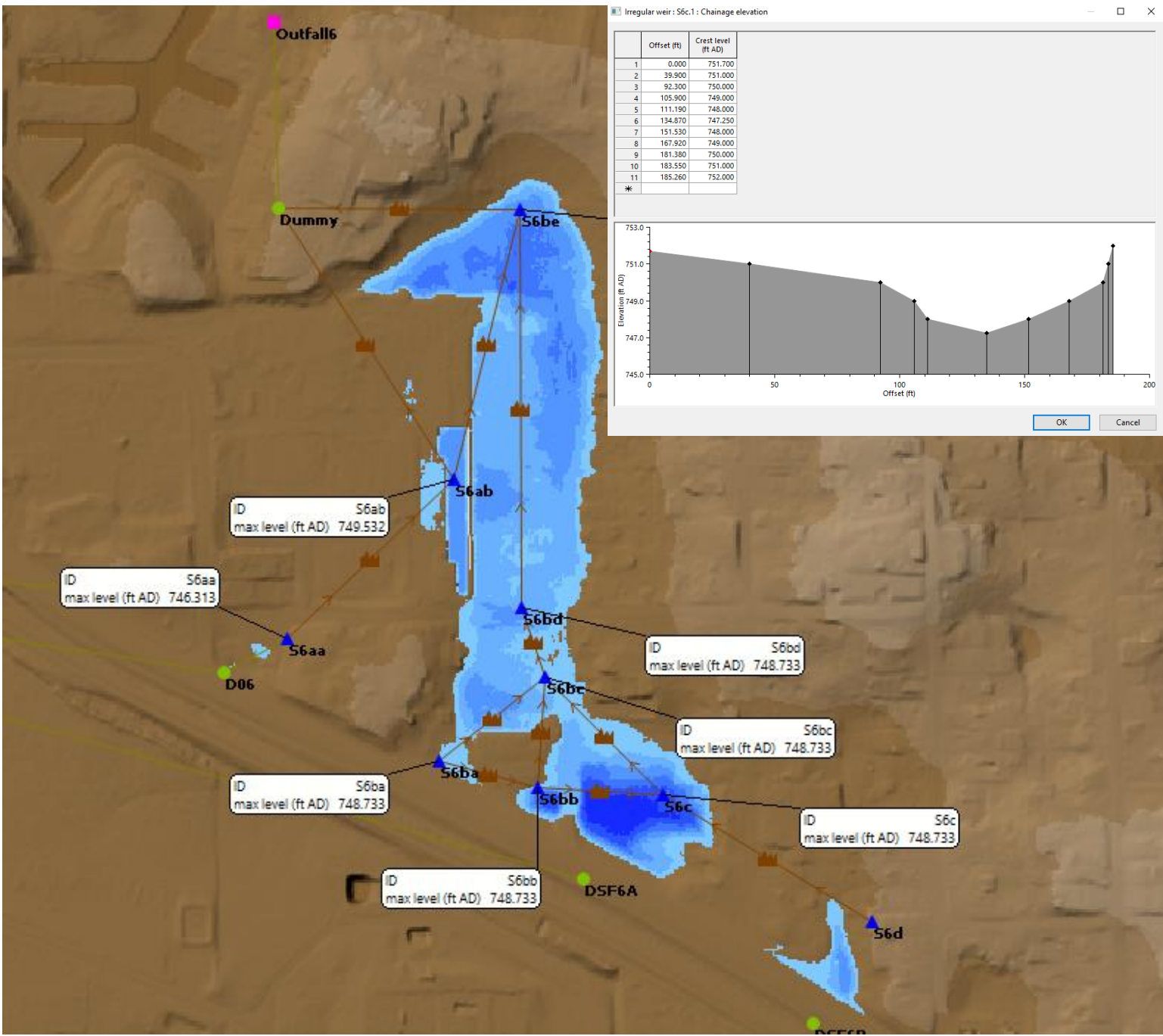


ICM SETUP



ICM SETUP

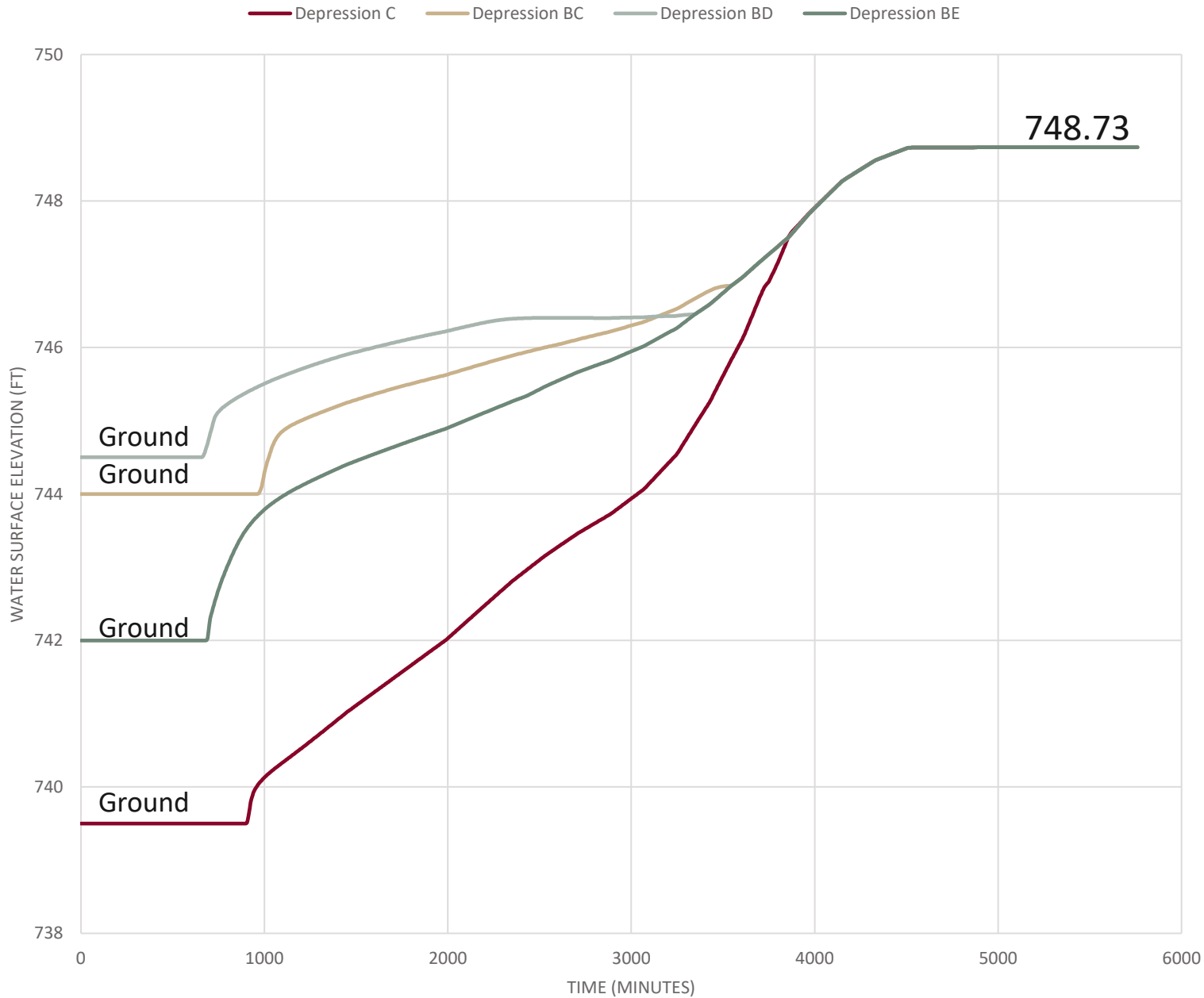
- Can do irregular weirs



ICM SETUP

- Can do irregular weirs
- Can automatically extract stage storage data directly from terrain

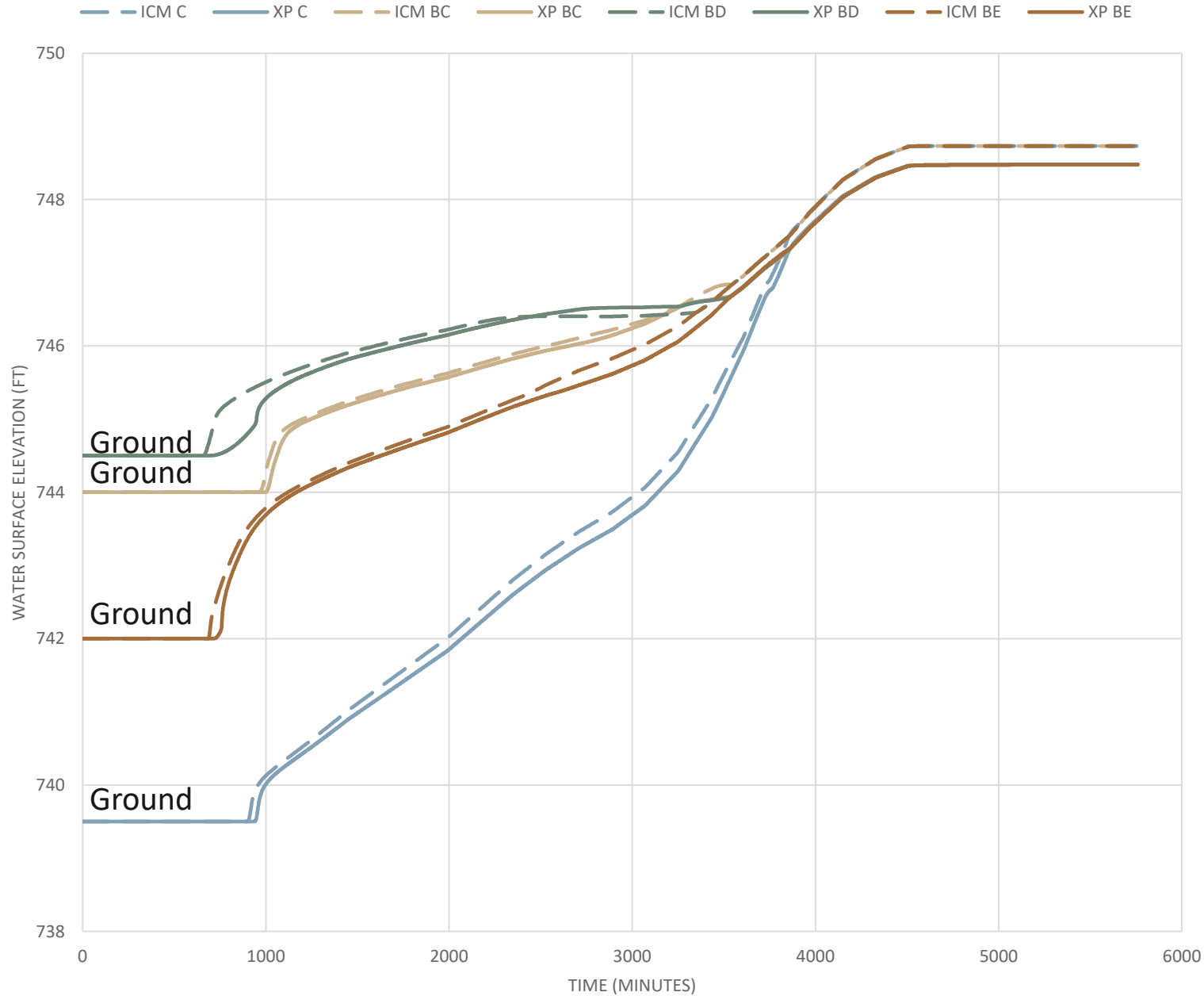
ICM RESULTS: WATER LEVELS



ICM INFOWORKS RESULTS (NATIVE BUILD)

- Using the irregular weir approach
- Each depression equalizes as expected

MODEL COMPARISON: WATER LEVELS



ICM VS XPSWMM

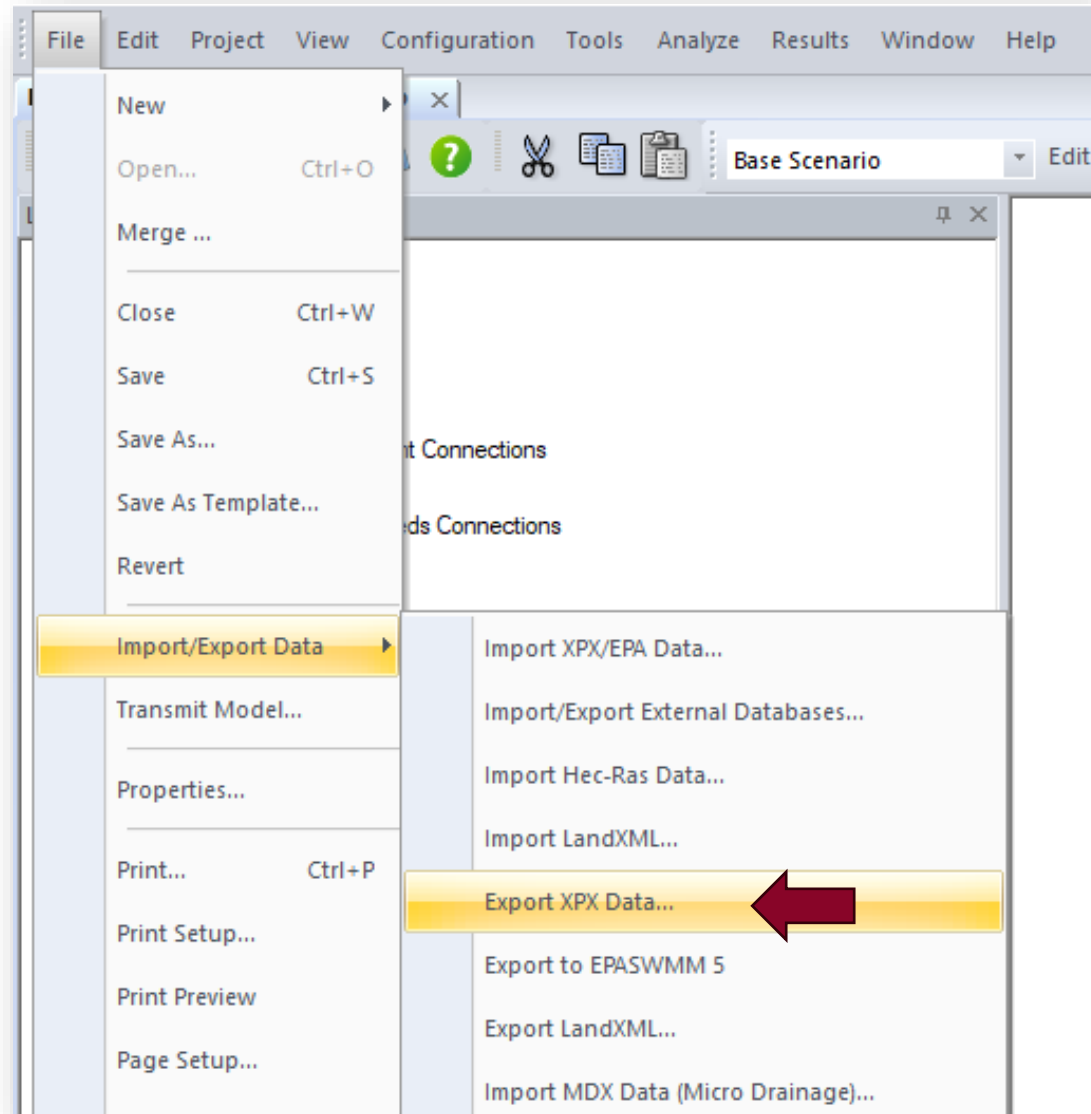
- Nearly identical time distribution



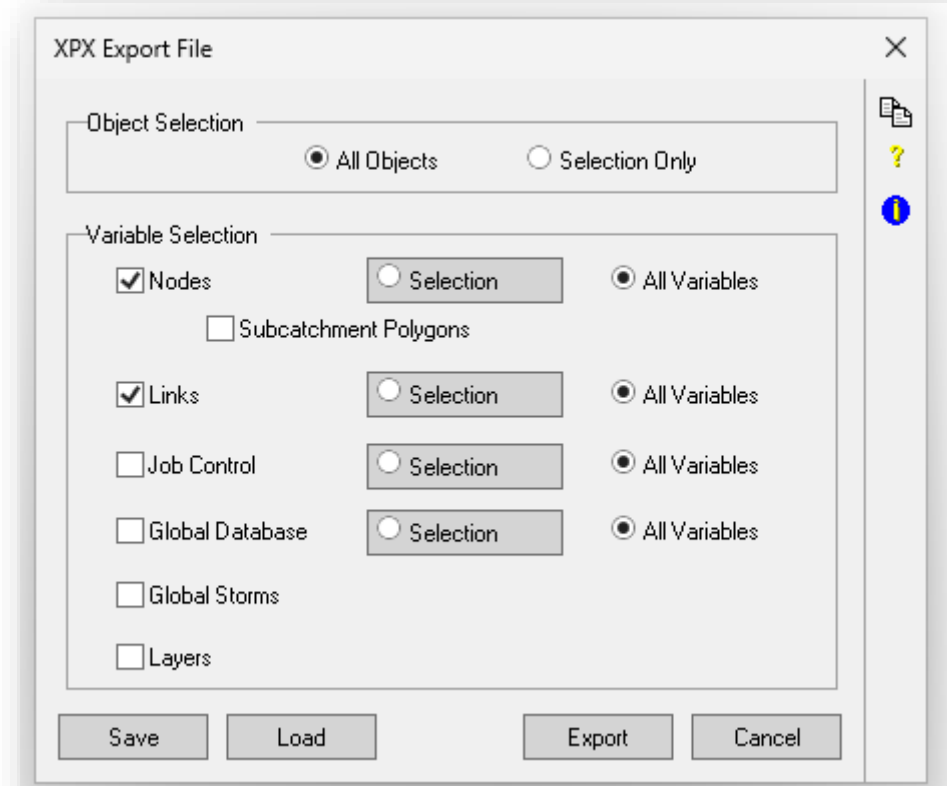
IMPORTING XPSWMM INTO ICM

- Simple theoretical process
- Lessons learned

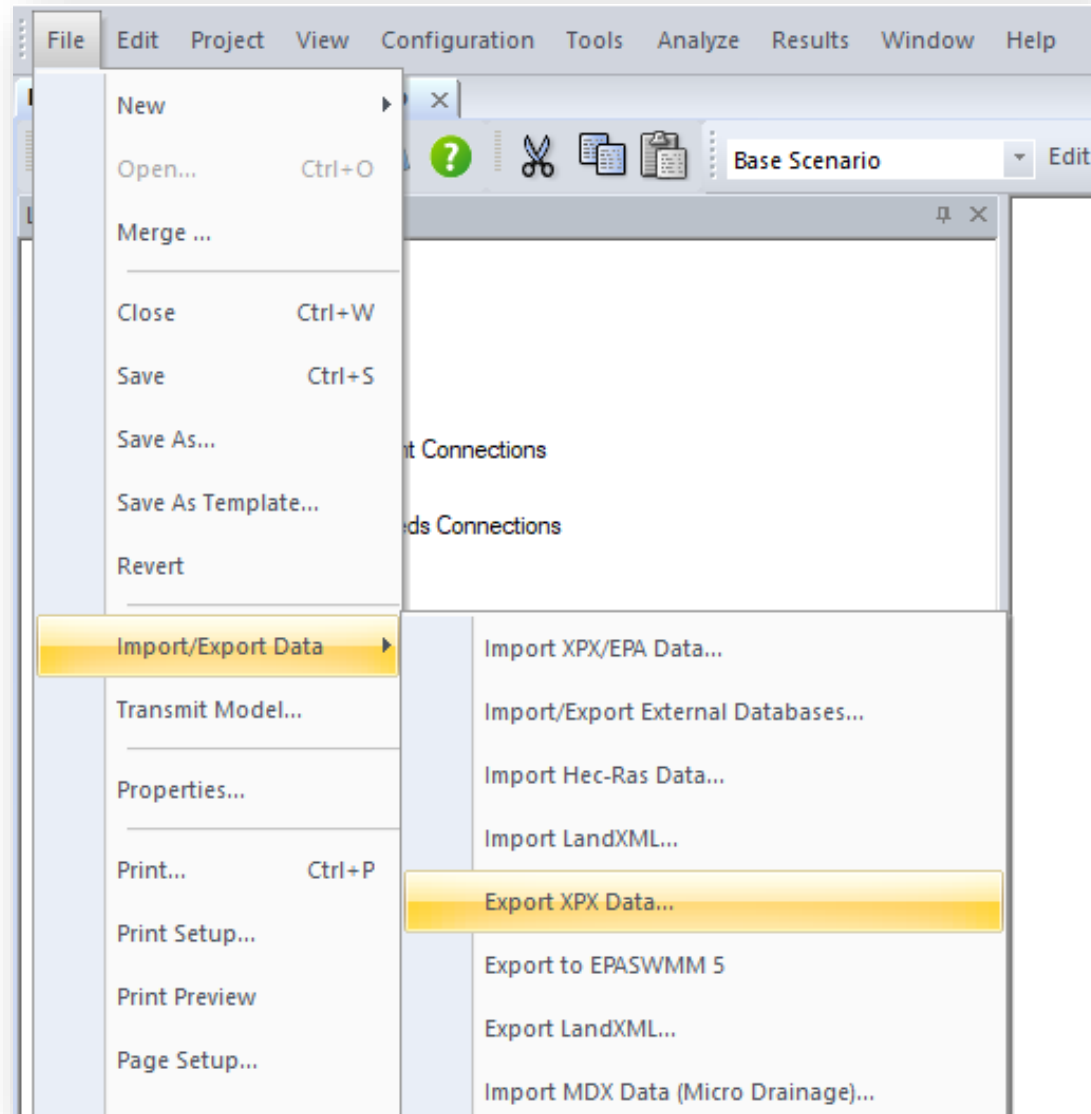
IMPORTING XPSWMM TO ICM PROCESS



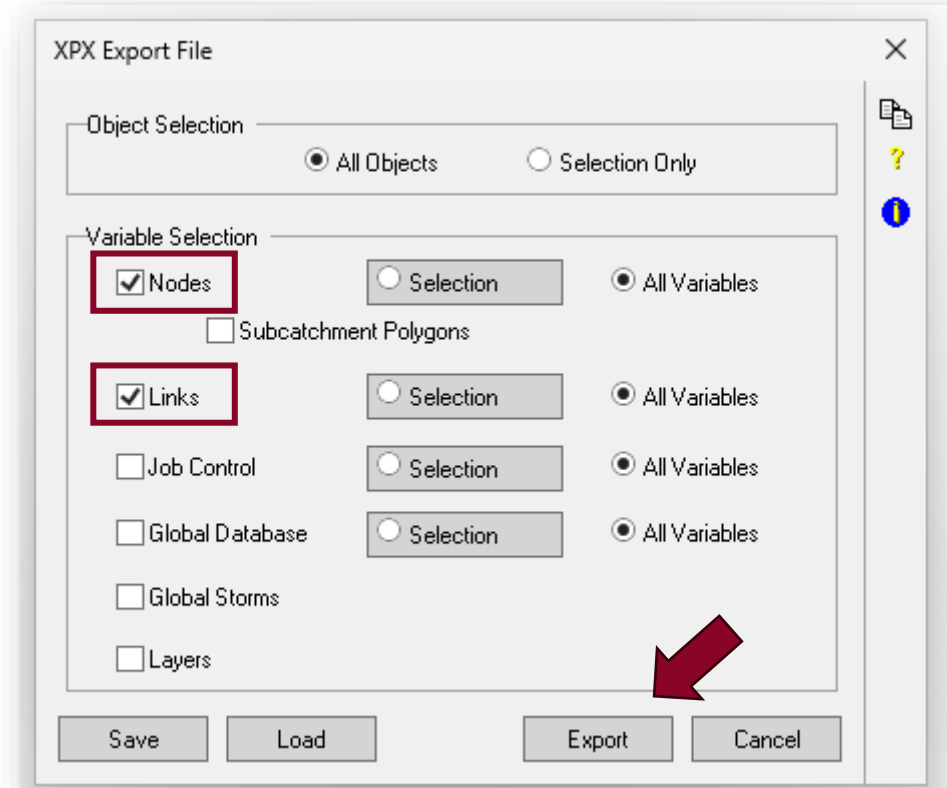
- Get .xpx file



IMPORTING XPSWMM TO ICM PROCESS

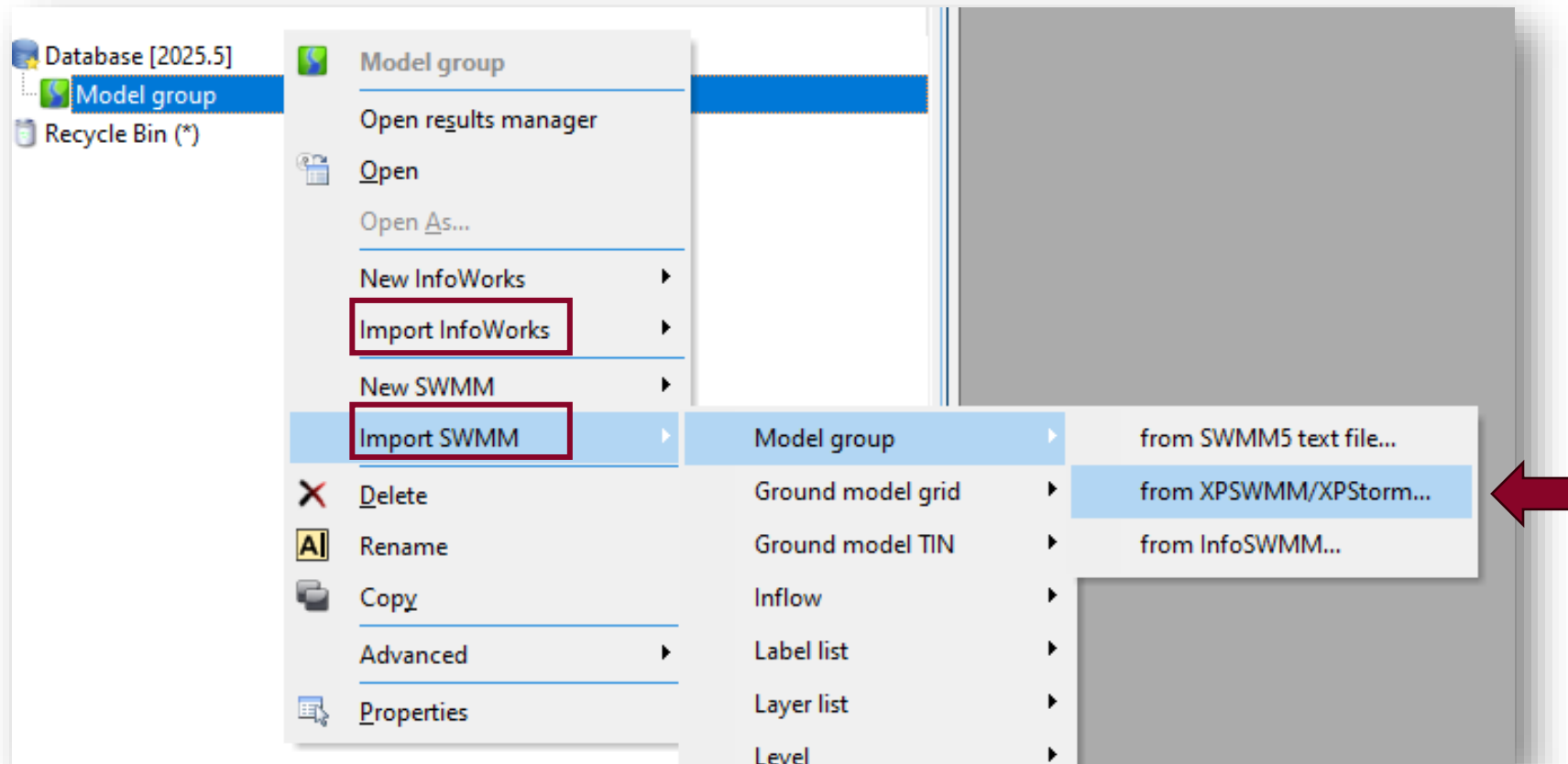


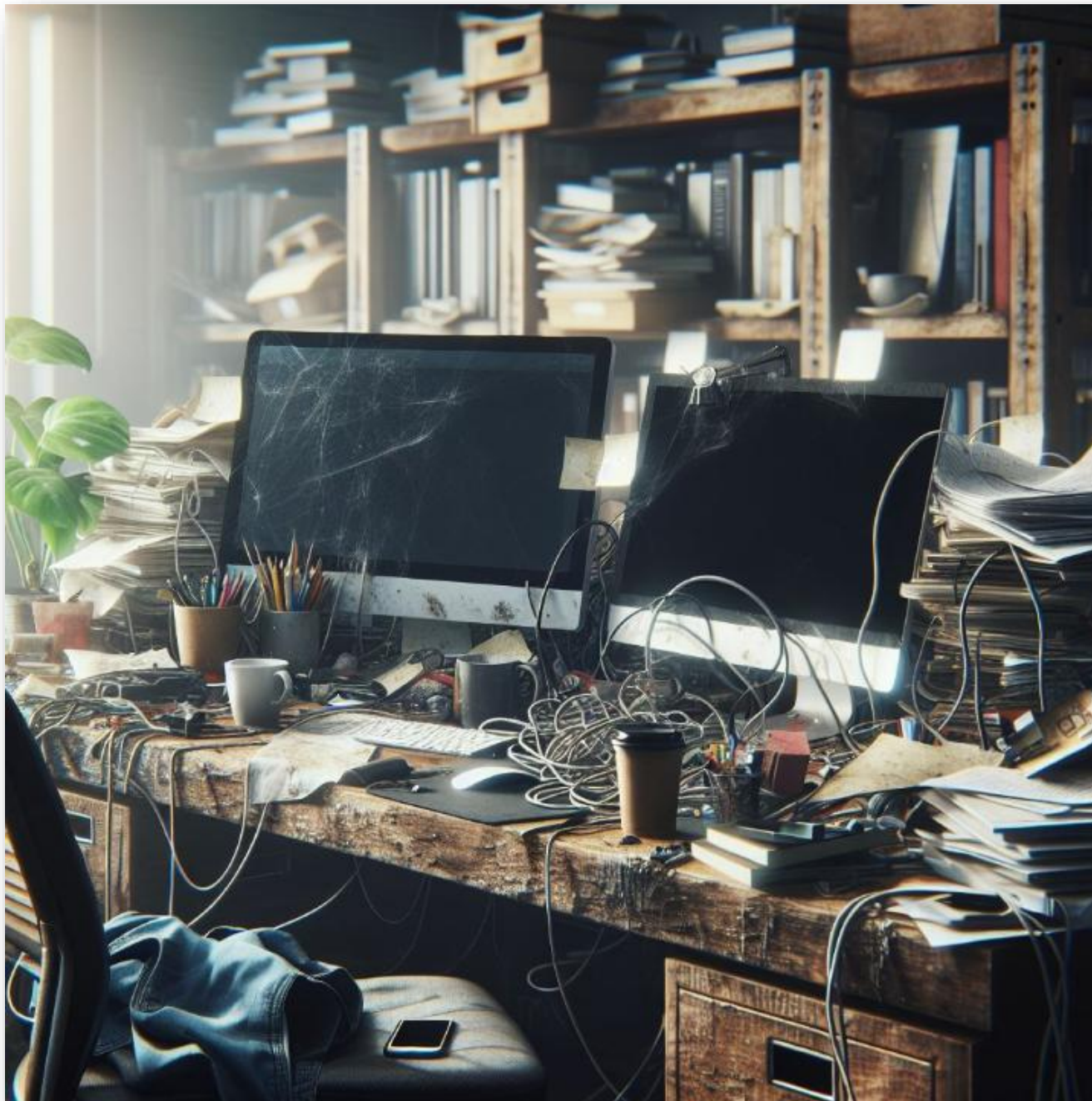
- Get .xpx file
- Select only Nodes & Links



IMPORTING XPSWMM TO ICM

- Get .xpx file
- Select only Nodes & Links
- Import to either Infoworks or SWMM



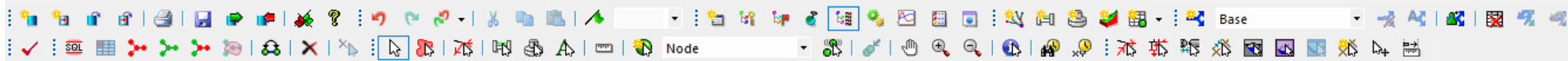


DEBUGGING IMPORT ISSUES



DEBUGGING IMPORT ISSUES

- Issue: Coordinate system stuck in metric



Properties

Conduit : Dummy Node.1 : DepressionStorage_modified_trial

Conduit Object Properties

Link definition

US node ID	Dummy Node	
DS node ID	Outfall	
Link suffix	1	
Link type	Cond	
Asset ID	Dummy Link	
Sewer reference		
System type	storm	
Branch ID		

Water quality settlement efficiency

US settlement efficiency (%)	0	#D
DS settlement efficiency (%)	0	#D

Conduit definition

Solution model	Full	#D
Minimum computational nodes	5	#D
Critical sewer category		
Taking off reference		
Conduit material	UNKN	#D
Design group		
Site condition	ROAD	#D
Ground condition	SUBURBS	#D
Conduit type	Conduit	#D

Cross section

Shape ID	CIRC	
Width (in)	120.0	
Height (in)	120.0	
Sediment depth (in)	0.0	
Number of barrels	1	

Roughness parameters

Roughness type	N	
Bottom roughness Manning's n	0.013	
Top roughness Manning's n	0.013	

Long section

Length (ft)	100.0	
Inflow (ft3/s)	0.0000	#D
Gradient (%)		
Full capacity (ft3/s)		
US invert level (ft AD)	740.000	
DS invert level (ft AD)	730.000	
US headloss type	Normal	#D
DS headloss type	Normal	#D
US headloss coefficient	1.00	#D
DS headloss coefficient	1.00	#D

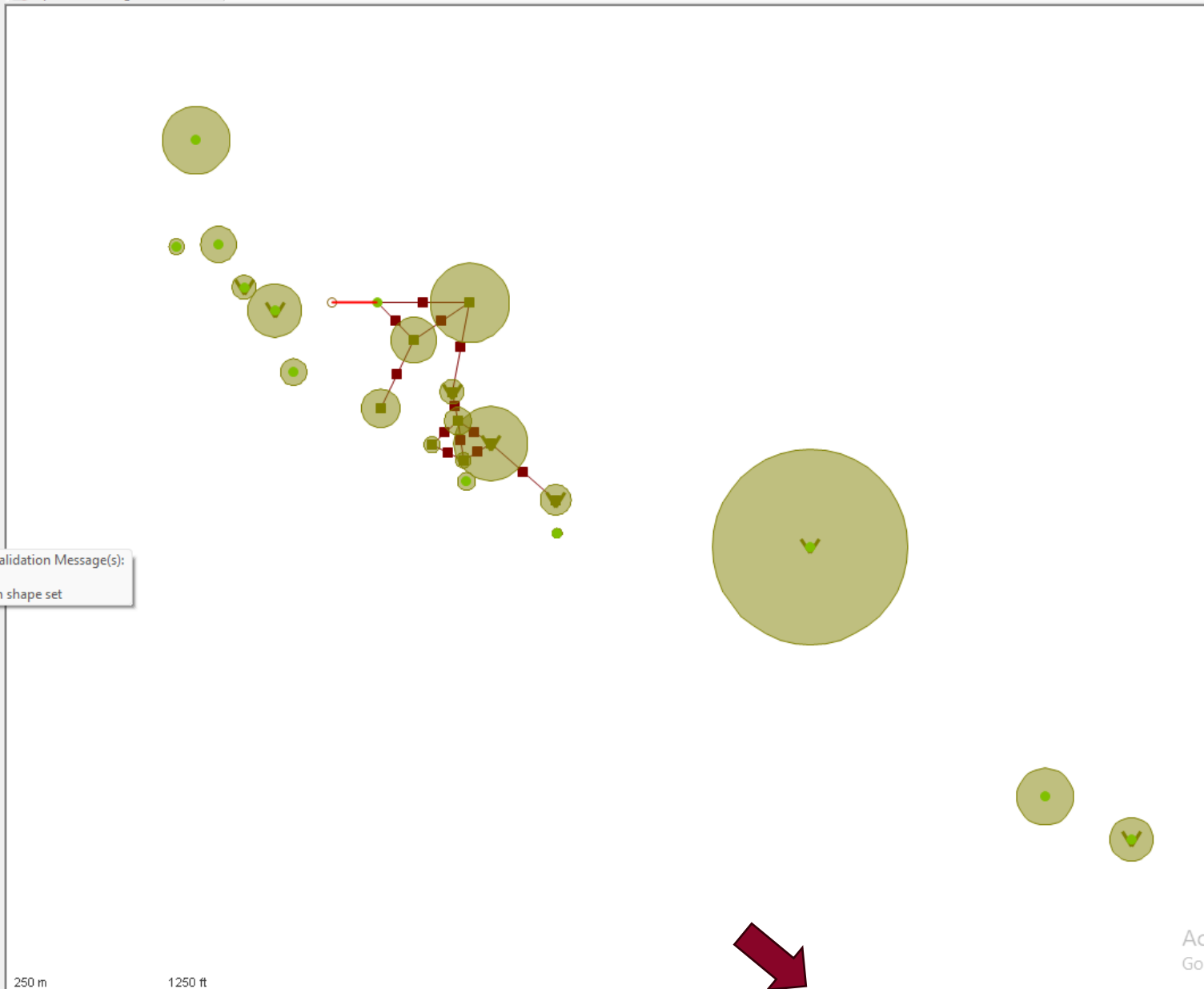
SUDS

Base height (in)	0.0	#D
Base infiltration loss coefficient (in/hr)	0.000	#D
Side infiltration loss coefficient (in/hr)	0.000	#D

Database [2025.5]

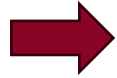
Properties

DepressionStorage_modified_trial



Shape ID has 1 Validation Message(s):

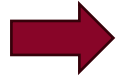
(1) E2070: Not in shape set



DATA	METRIC	" "	0	1	"0"
NODE 133	"C6aa"	1026879.6042	2085528.7704		
NODE 133	"C6ab"	1027062.6486	2085902.2151		
NODE 133	"C6be"	1027369.6033	2086107.8747		
NODE 133	"C6bd"	1027271.3778	2085619.8168		
NODE 133	"C6bc"	1027305.1428	2085458.9055		
NODE 133	"C6ba"	1027162.0297	2085329.0765		
NODE 133	"C6bb"	1027333.22	2085243.5627		
NODE 133	"C6c"	1027484.0974	2085335.5097		
NODE 133	"C6d"	1027842.0065	2085026.4734		
NODE 134	"Dummy Node"	1026860.0365	2086108.598		
NODE 134	"Outfall"	1026611.816	2086107.4987		
NODE 134	"C01"	1025864.3185	2087001.0911		
NODE 134	"C02b"	1025987.8742	2086428.6164		
NODE 134	"C03"	1026127.904	2086193.8606		
NODE 134	"C04"	1026296.7635	2086066.1863		
NODE 134	"C05"	1026399.7266	2085728.4674		
NODE 134	"C07"	1029241.5076	2084768.8515		
NODE 134	"C08"	1030534.7239	2083397.3833		
NODE 134	"C09"	1031008.3541	2083162.6275		

DEBUGGING IMPORT ISSUES

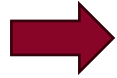
- **Issue:** Coordinate system stuck in metric
- **Fix:**
 - ❑ Open .xpx file in any text editor



```
DATA METRIC "" 0 1 "0"
NODE 133 "C6aa" 1026879.6042 2085528.7704
NODE 133 "C6ab" 1027062.6486 2085902.2151
NODE 133 "C6be" 1027369.6033 2086107.8747
NODE 133 "C6bd" 1027271.3778 2085619.8168
NODE 133 "C6bc" 1027305.1428 2085458.9055
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```

DEBUGGING IMPORT ISSUES

- **Issue:** Coordinate system stuck in metric
- **Fix:**
 - ☐ Open .xpx file in any text editor
 - ☐ Write: DATA METRIC "" 0 1 "0"



```
DATA METRIC "" 0 1 "0"
NODE 133 "C6aa" 1026879.6042 2085528.7704
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NODE 134 "C08" 1030534.7239 2083397.3833
NODE 134 "C09" 1031008.3541 2083162.6275
```

DEBUGGING IMPORT ISSUES

- **Issue:** Coordinate system stuck in metric
- **Fix:**
 - ✓ Open .xpx file in any text editor
 - ✓ Write: DATA METRIC "" 0 1 "0"
 - ✓ Issue persists in both Infoworks networks and SWMM networks



CONTINUING WITH
ISSUES UNIQUE TO
INFOWORKS



CONTINUING WITH ISSUES UNIQUE TO INFOWORKS

- **Issue:** Pipe shapes unavailable

FileEditNetworkSelectionGeoPlanModelResultsActionsToolsWindowHelp

Base

Node

Conduit : Dummy Node.1 : DepressionStorage_modified_trial

Conduit Object Properties

Link definition

US node ID
DS node ID
Link suffix
Link type
Asset ID
Sewer reference
System type
Branch ID

Dummy Node
Outfall
1
Cond
Dummy Link

storm

Water quality settlement efficiency

US settlement efficiency (%)
DS settlement efficiency (%)

0
0

#D
#D

Conduit definition

Solution model
Minimum computational nodes
Critical sewer category
Taking off reference
Conduit material
Design group
Site condition
Ground condition
Conduit type

Full
5

UNKN

ROAD
SUBURBS
Conduit

#D
#D

#D
#D
#D

Cross section

Shape ID
Width (in)
Height (in)
Sediment depth (in)
Number of barrels

CIRC
120.0
120.0
0.0
1

Shape ID has 1 Validation Message(s):

(1) E2070: Not in shape set

Roughness parameters

Roughness type
Bottom roughness Manning's n
Top roughness Manning's n

N
0.013
0.013

Long section

Length (ft)
Inflow (ft3/s)
Gradient (%)
Full capacity (ft3/s)
US invert level (ft AD)
DS invert level (ft AD)
US headloss type
DS headloss type
US headloss coefficient
DS headloss coefficient

100.0
0.0000

740.000
730.000
Normal
Normal
1.00
1.00

#D

#D
#D
#D
#D

SUDS

Base height (in)
Base infiltration loss coefficient (in/hr)
Side infiltration loss coefficient (in/hr)

0.0
0.000
0.000

#D
#D
#D

Database [2025.5]Properties

DepressionStorage_modified_trial

250 m1250 ft

Ground condition

Conduit type

Cross section

Shape ID

Width (in)

Height (in)

Sediment depth (in)

Number of barrels

Roughness parameters

Suburbs

Conduit

CIRC

120.0

120.0

0.0

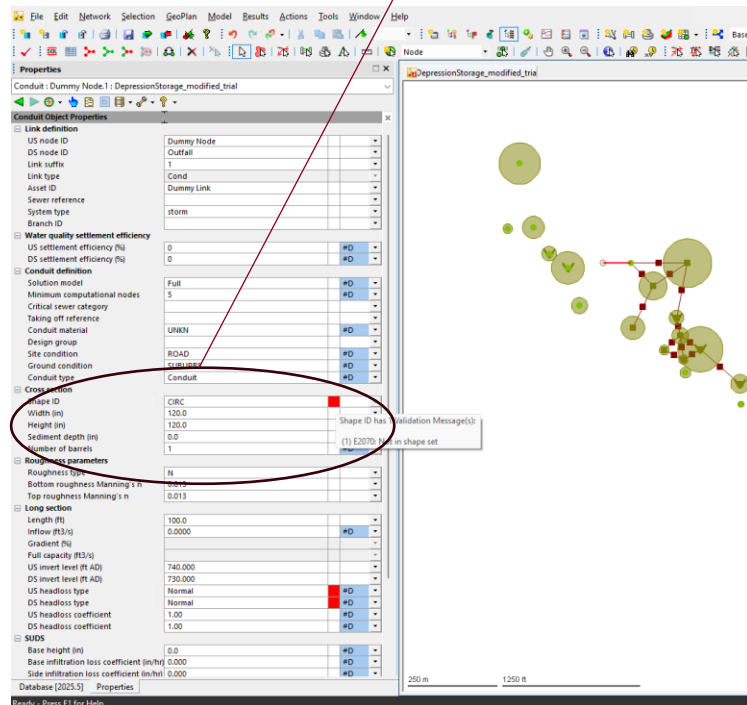
1

Shape ID has 1 Validation Message(s):

(1) E2070: Not in shape set

Ready - Press F1 for Help

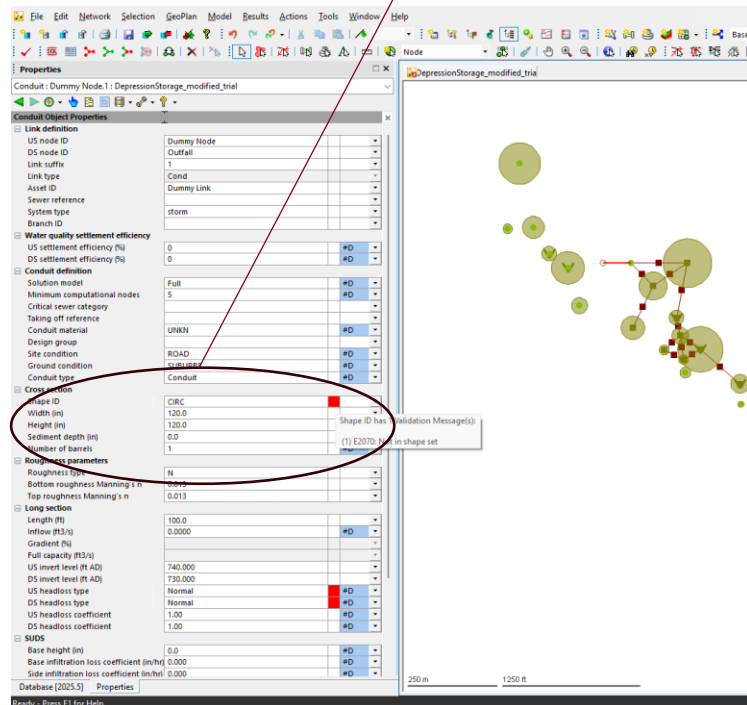
Ground condition	Suburban	#D
Conduit type	Conduit	#D
Cross section		
Shape ID	CIRC	Shape ID has
Width (in)	120.0	
Height (in)	120.0	
Sediment depth (in)	0.0	(1) E2070: N
Number of barrels	1	
Roughness parameters		



DEBUGGING IMPORT ISSUES (INFOWORKS)

- Issue: Pipe shapes unavailable
- Fix:
 - ✓ Validate the model

Ground condition	Suburban	#D
Conduit type	Conduit	#D
Cross section		
Shape ID	CIRC	Shape ID has
Width (in)	120.0	(1) E2070: N
Height (in)	120.0	
Sediment depth (in)	0.0	
Number of barrels	1	
Roughness parameters		



DEBUGGING IMPORT ISSUES (INFOWORKS)

- Issue: Pipe shapes unavailable
- Fix:
 - ✓ Validate the model
 - ✓ Use ICM SWMM

Configuration Parameters

Parameters

AE
MINLEN=4

AE

OK

Cancel

Help

Add

Delete

Enable

Disable

DEBUGGING IMPORT ISSUES

- Issue: ICM does not recognize AE configuration code

Configuration Parameters

Parameters

AE
MINLEN=4

AE

OK

Cancel

Help

Add

Delete

Enable

Disable

DEBUGGING IMPORT ISSUES

- Issue: ICM does not recognize AE configuration code
- Fixes:
 - ✓ Do not use AE code...

Configuration Parameters

Parameters

AE
MINLEN=4

AE

OK

Cancel

Help

Add

Delete

Enable

Disable

DEBUGGING IMPORT ISSUES

- Issue: ICM does not recognize AE configuration code
- Fixes:
 - ✓ Do not use AE code...
 - ✓ Write a script that manipulates .xpx file

Configuration Parameters

Parameters

AE
MINLEN=4

AE

OK

Cancel

Help

Add

Delete

Enable

Disable

DEBUGGING IMPORT ISSUES

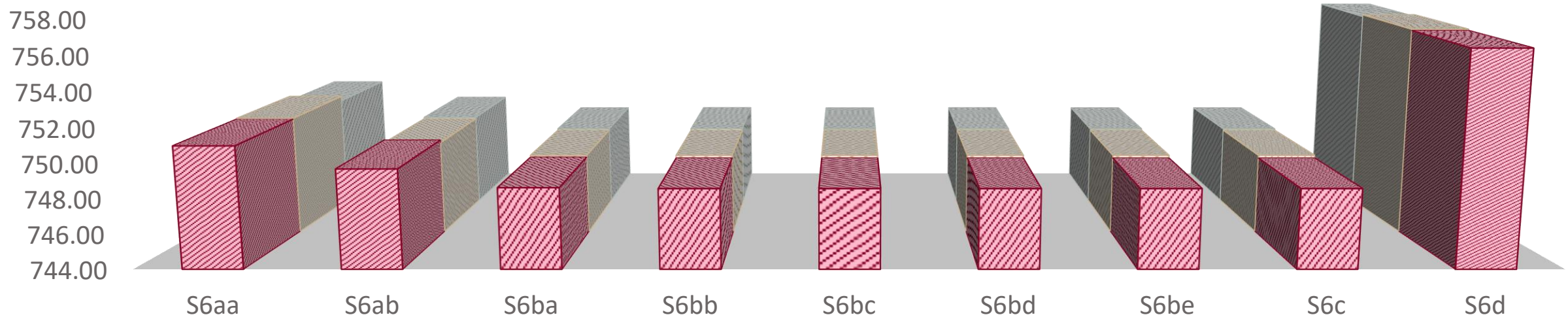
- Issue: ICM does not recognize AE configuration code
- Fixes:
 - ✓ Do not use AE code...
 - ✓ Write a script that manipulates .xpx file
 - ✓ Use ICM SWMM

COMPARING MODELS!

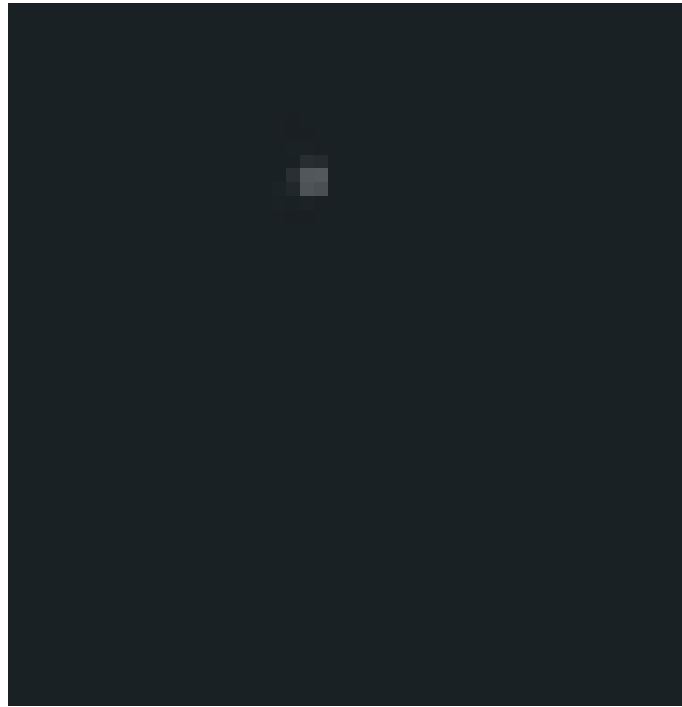
- Results consistent

72-HR PEAK WSE

XPSWMM ICM NATIVE ICM IMPORT



REPLICATING IN HEC-RAS



REPLICATING IN HEC-RAS

- Storage areas and 2D areas

REPLICATING IN HEC-RAS

- Storage areas and 2D areas
- Moving toward fully geospatial

REPLICATING IN HEC-RAS

- Storage areas and 2D areas
- Moving toward fully geospatial
- Pipe networks!

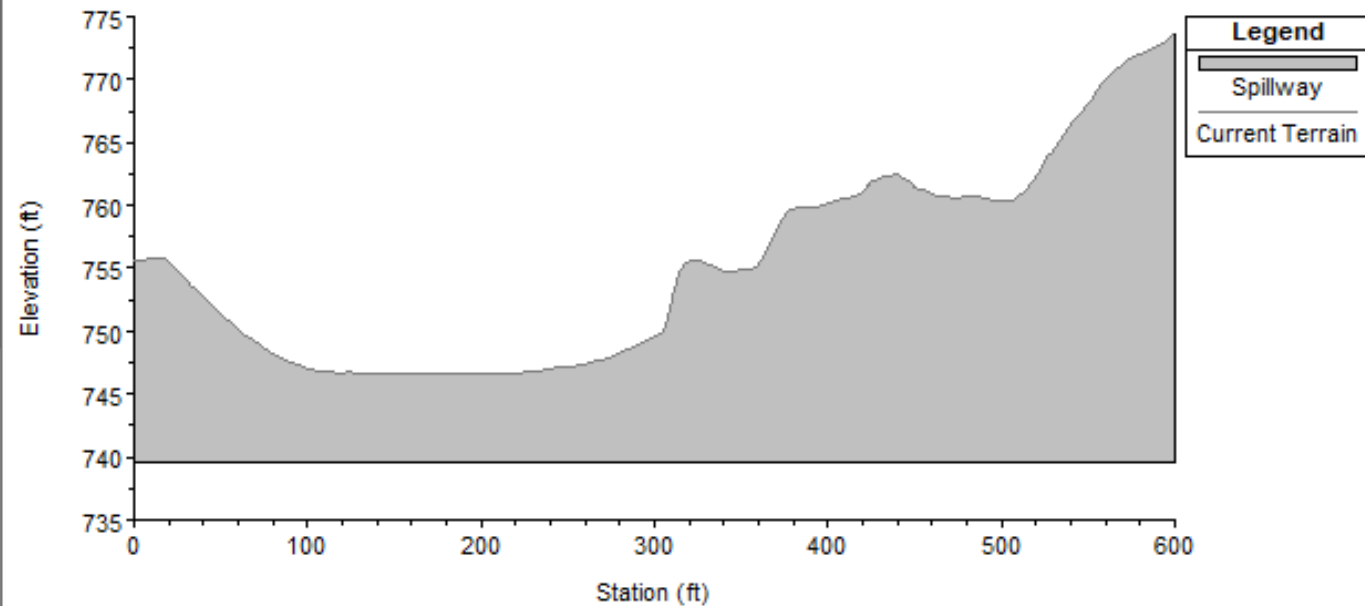
REPLICATING IN HEC-RAS

- Storage areas and 2D areas
- Moving toward fully geospatial
- Pipe networks!
- The right cost (free!!)

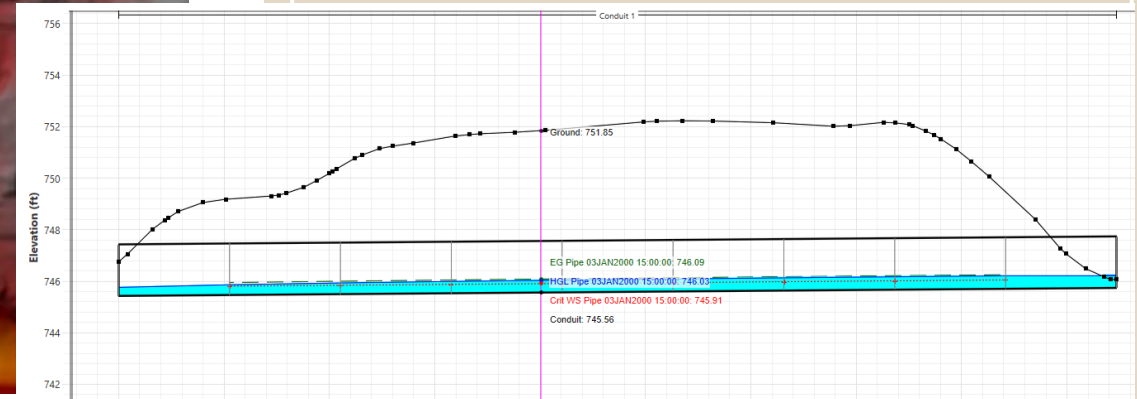
REPLICATING IN RAS

- Weirs modeled as SA/2D connections
- Pipe network objects can connect storage areas

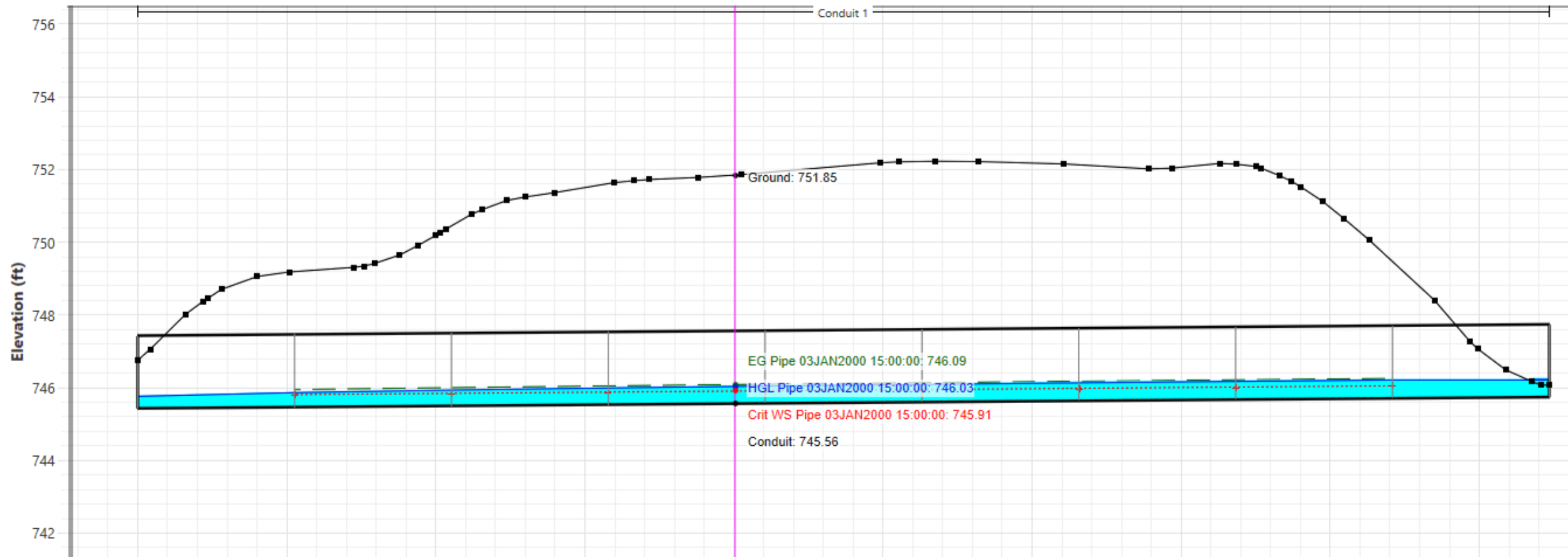
Conn_2_5



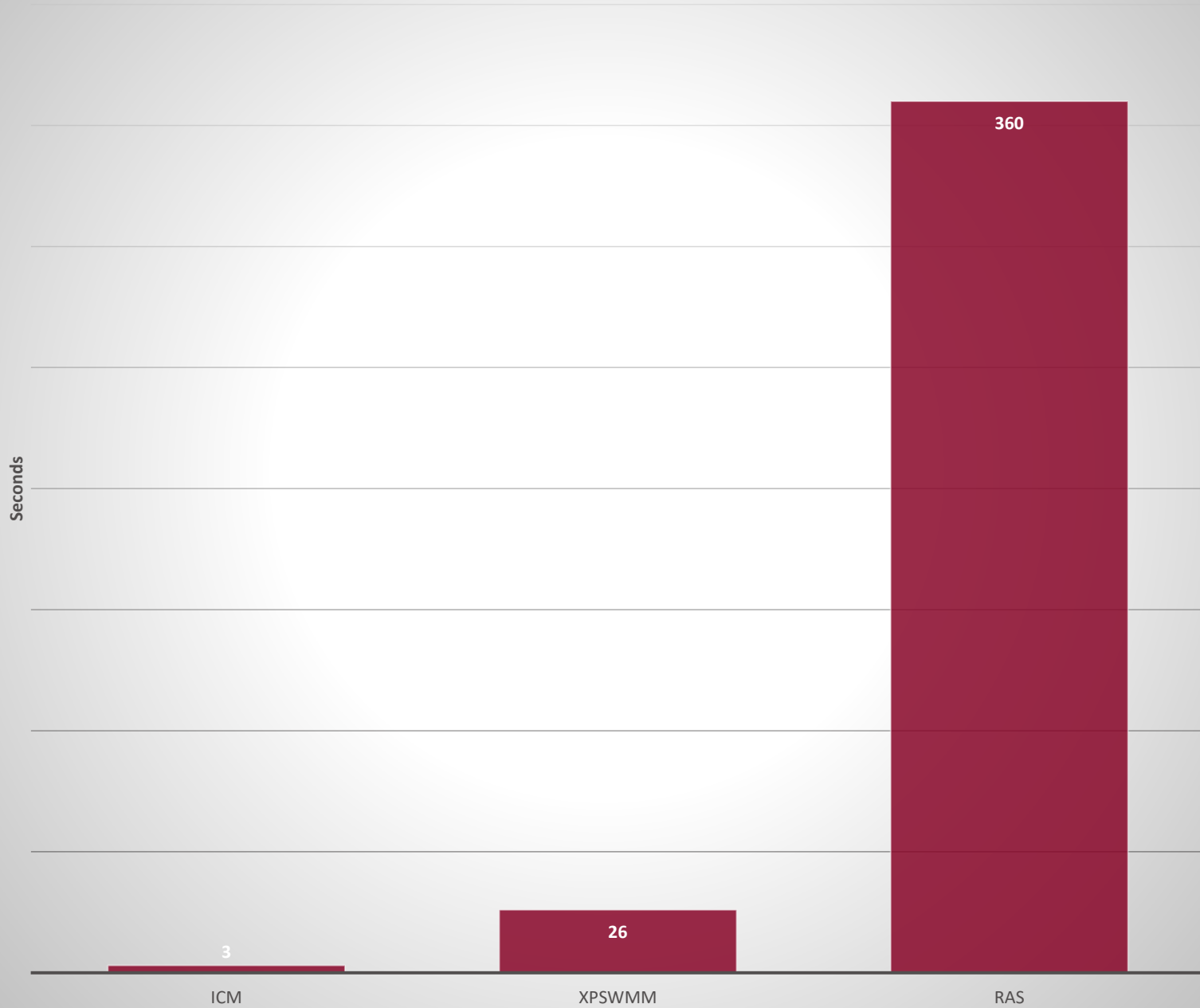
REPLICATING IN RAS



REPLICATING IN RAS

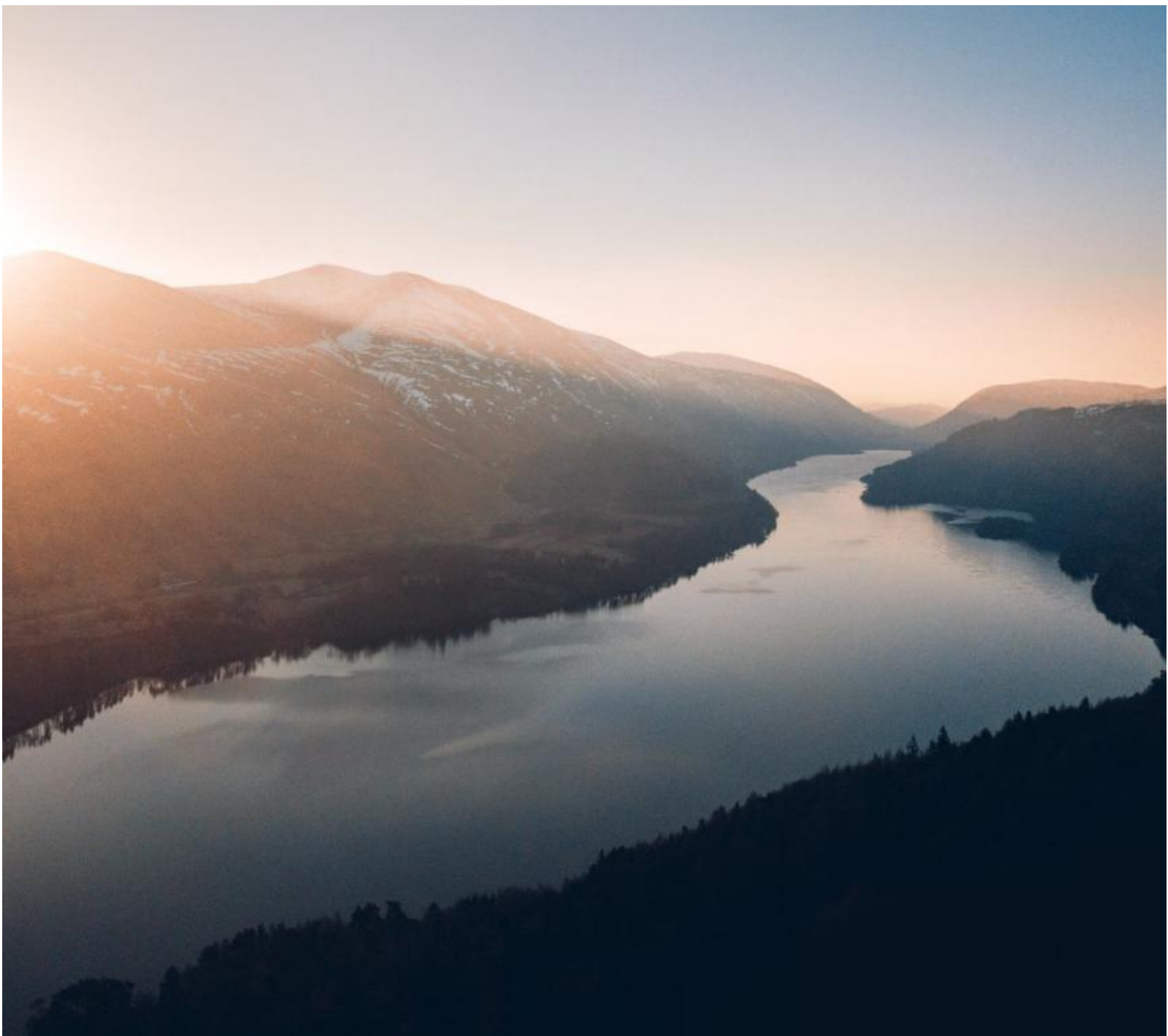


Simulation Runtime Comparison



RUN-TIMES

- 100-yr, 72-hr Storm
- Dynamic Wave: ICM & XPSWMM
- Diffusion Wave: RAS



LESSONS LEARNED & THOUGHTS

- RAS is not a swmm tool (...yet??)
- ICM has many advantages and new tools
- If importing xpswmm models into ICM, use ICM SWMM for compatibility
- Consider building a script for import efficiency
- Xpswmm, ICM, RAS results are comparable

THANK YOU!

Conner Ray: cray@v3co.com